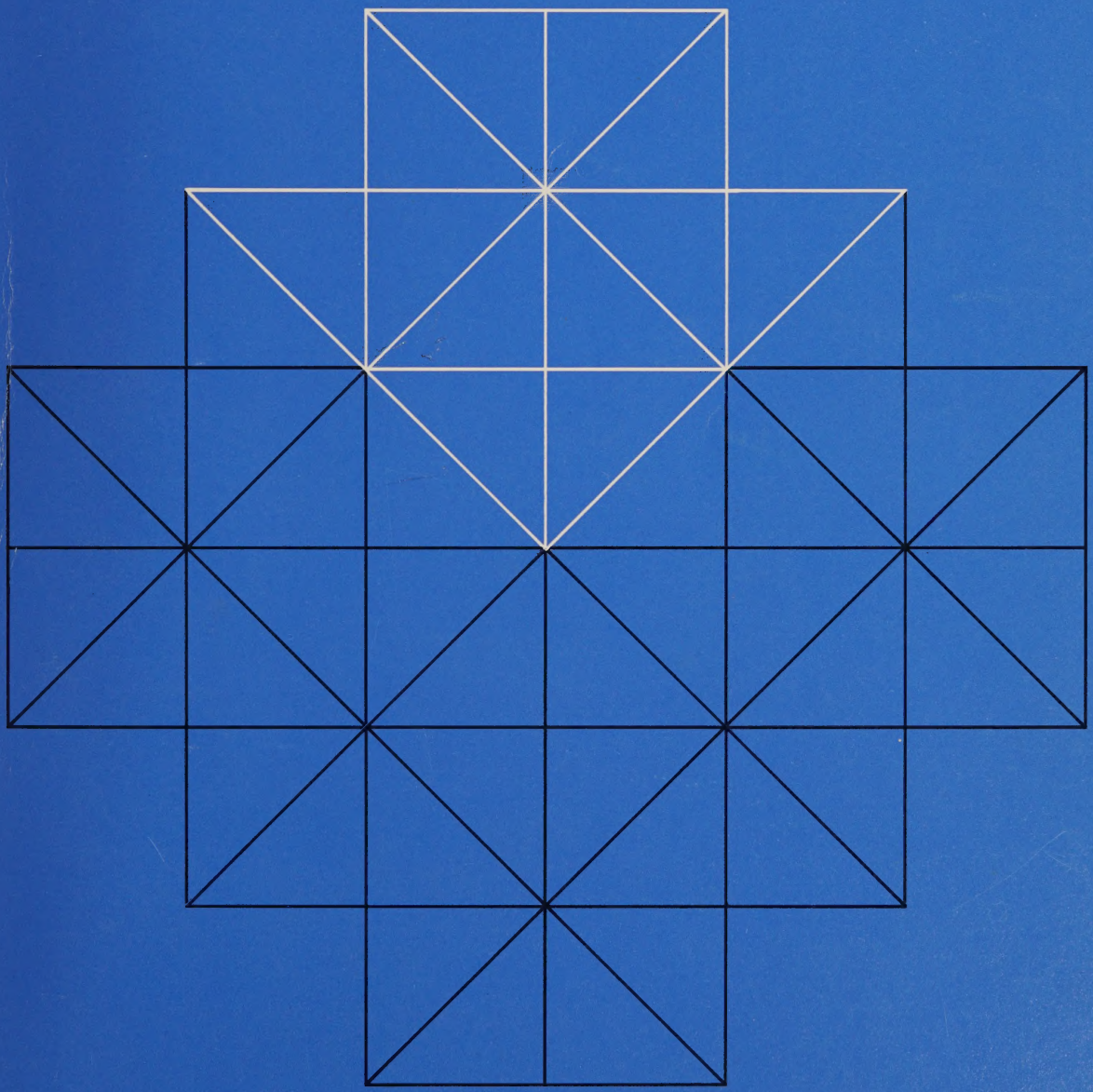
Rush-
Presbyterian-
St. Luke's
Medical Center
Chicago

Rush University College of Health Sciences and Graduate School Bulletin 1980-81



Rush University Tentative Calendar

1980-1981

1980-1981

Fall Quarter	Orientation and Registration for New Students	September 16-19
	Classes Begin	September 22
	Classes End	November 26
	Thanksgiving Recess	November 26-30
	Examination Period	December 1-5
	Holiday Break	December 6-January 4
Winter Quarter	Classes Begin	January 5
	Classes End	March 13
	Examination Period	March 16-20
	Break	March 21-27
Spring Quarter	Classes Begin	March 30
	Memorial Day—No Classes	May 25
	Examination Period	June 8-12
	Commencement	June 13
	Break	June 13-21
Summer Quarter	Classes Begin	June 22
	Independence Day—No Classes	July 3
	Classes End	August 26
	Examination Period	August 28-29
	Break	August 30-September 7

1981-1982

Fall Quarter	Orientation and Registration for New Students	September 8-9
	Labor Day	September 7
	Classes Begin	September 10
	Classes End	November 18
	Examination Period	November 19-25
	Thanksgiving Recess	November 26-29
Winter Quarter	Classes Begin	November 30
	Holiday Break	December 23-January 3
	Classes Resume	January 4
	Classes End	February 24
	Examination Period	February 25-March 3
	Break	March 4-10
Spring Quarter	Classes Begin	March 11
	Classes End	May 26
	Examination Period	May 27-June 3
	Memorial Day—No Classes or Exams	May 31
	Commencement	June 5
Summer Quarter	Classes Begin	June 7
	Independence Day—No Classes	July 5
	Classes End	August 13
	Examination Period	August 16-20
	Break	August 21-September 7

Medical College clerkships follow a different calendar which appears in the Medical College Bulletin

1980-1981

Rush-
Presbyterian-
St. Luke's
Medical
Center

Chicago

Rush University College of Health Sciences and Graduate School Bulletin

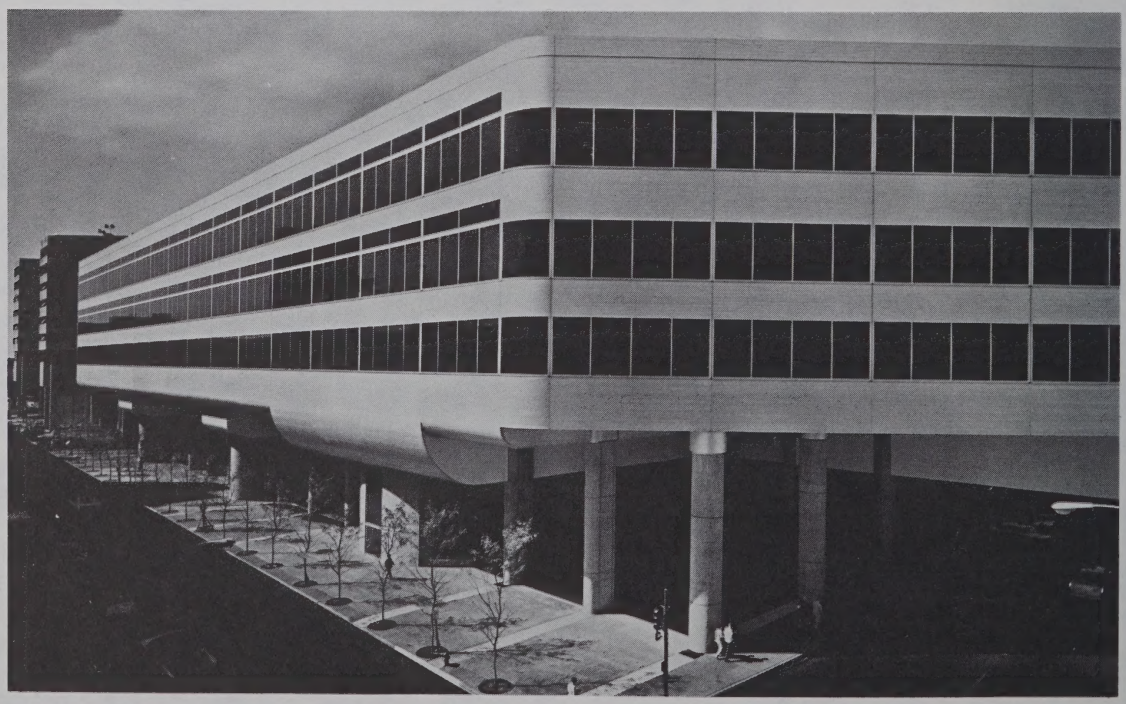
This bulletin is published for the faculty, students, and prospective students of the College of Health Sciences of Rush University. The university reserves the right to make changes in any or all specifications contained herein and to apply such revisions to present and new students alike.

Rush University
The College of Health Sciences
600 South Paulina Street
Chicago, Illinois 60612
(312) 942-5099

Rush University Programs in the Health Professions

1980-1981

College of Health Sciences	Bachelor of Science Medical Technology Master of Science Clinical Nutrition Health Systems Management Audiology Speech-Language Pathology Doctor of Philosophy Anatomy Immunology Pharmacology Physiology
Rush Medical College	Doctor of Medicine
The College of Nursing	Bachelor of Science Master of Science with majors in Anesthesia Nurse Practitioner Community Nurse Pracitioner Gerontological Nursing Medical/Surgical Nursing Oncology Nursing Psychiatric Nursing Rehabilitation Nursing Non-degree Nurse Practitioner Tracks Adult Health Obstetrics/Gynecologic Pediatric Doctor of Nursing Science



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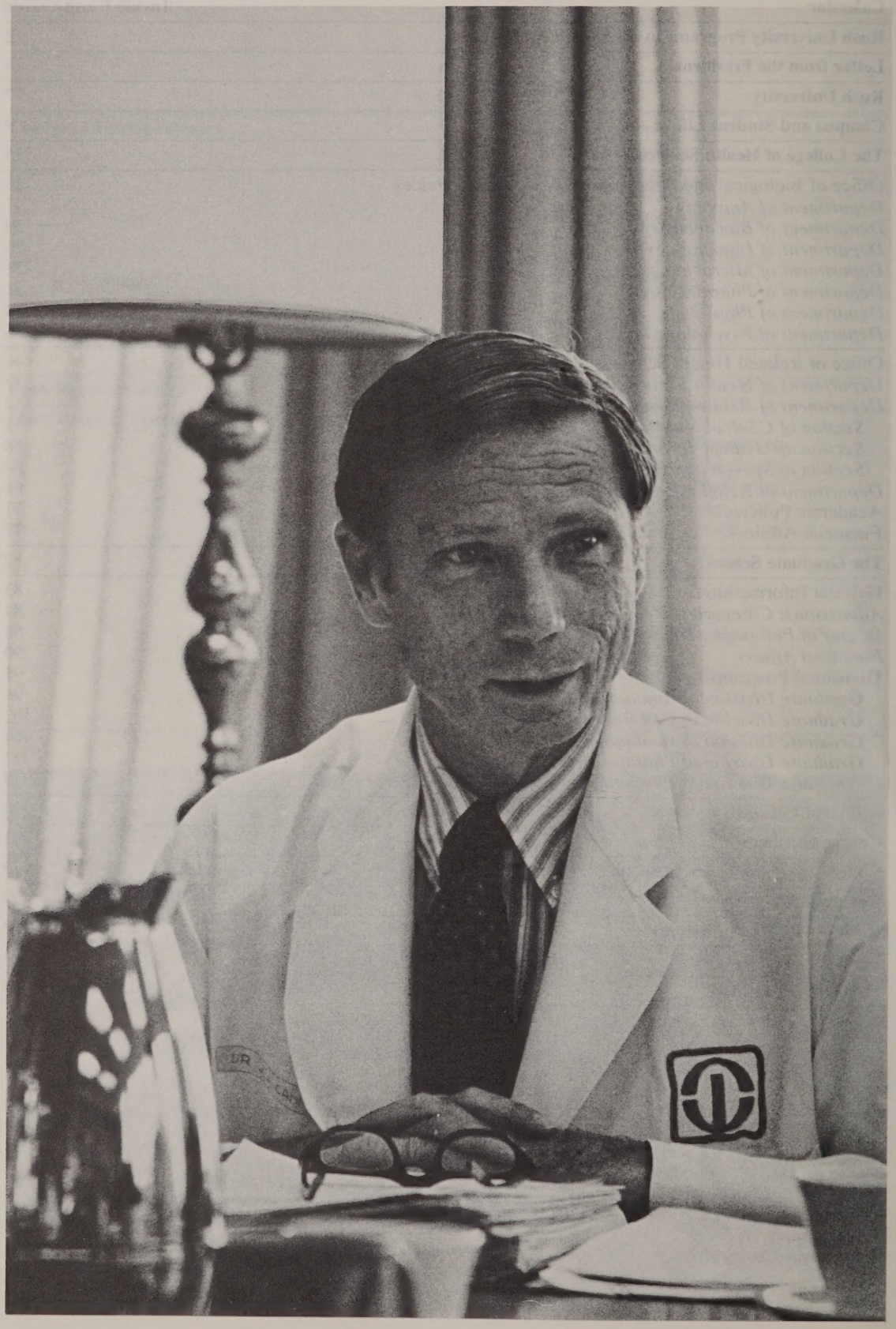
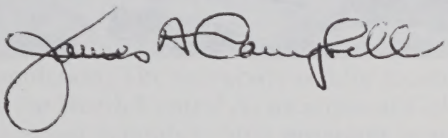


The concept of an academic health center has gained recognition throughout the United States as an important organizing principle for patient services, scientific inquiry, and health education. At Rush-Presbyterian-St. Luke's Medical Center, our approach in the development of such a center is based on a commitment to orderly and balanced growth among all the components — patient care, education, and research.

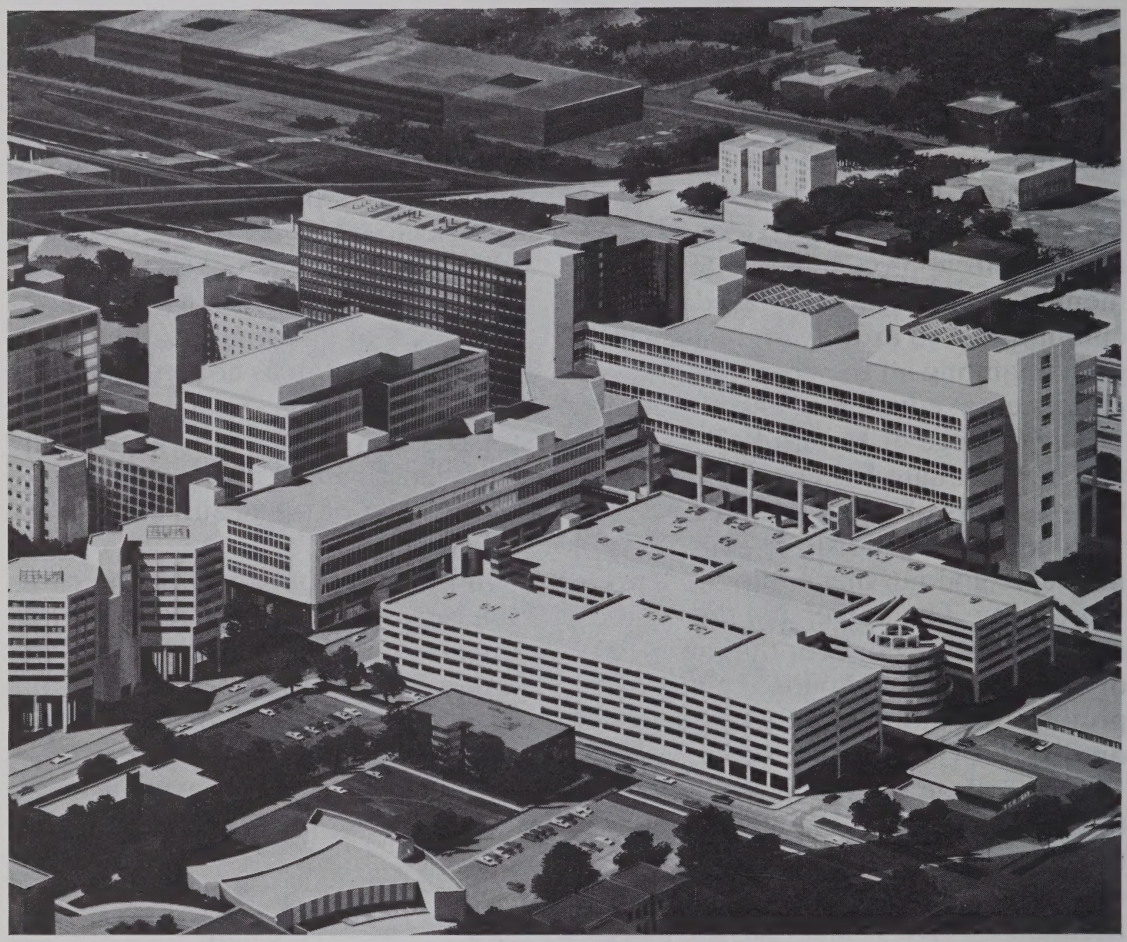
The College of Health Sciences and its Graduate School arise out of the strengths of these components. This college and its sister colleges of medicine and nursing comprise Rush University. The university, therefore, exemplifies the concept that an organized system of patient care must produce the individuals necessary to optimal provision of such care.

The College of Health Sciences, through its basic and applied science faculties, has a number of charges expressive of the overall goal of the Medical Center. It is largely responsible for developing and maintaining a level of excellence in furthering investigation of the increasingly complex problems related to the understanding of health and its impairments. It is responsible for the education of students in those professional scientific areas needed to support the most effective approaches to health care. It is also responsible for the doctoral education of students in those basic biological and behavioral research skills that are fundamental in gaining understanding of the human condition. In all of its programs, the college appropriately is committed to the belief that scientists and professionals, in areas of health care other than medicine and nursing, are an integral part of the health care endeavor.

To those of you who will enter the college as students, I extend the welcome of our Medical Center and university and the invitation to share our objectives. Your responsibility is to grow. Our responsibility here is to nurture your growth in every way we can.



James A. Campbell, M.D.
President



The University

The establishment of Rush University in 1972 by the trustees of Rush-Presbyterian-St. Luke's Medical Center represents a combined heritage that stretches back to 1837. On March 2 of that year, the Illinois State Legislature chartered Rush Medical College — two days before the city of Chicago was incorporated.

The Rush Medical College tradition began with Dr. Daniel Brainard, the founder, and Dr. Benjamin Rush, a signer of the Declaration of Independence and the physician for whom the college was named. Dr. Brainard was a distinguished surgeon and scientific investigator who led Rush Medical College to exert strong influence on medical practice and scientific research. Two years after the establishment of the medical college, Dr. James Van Zandt Blaney, a member of the faculty, opened the first free medical dispensary west of the Allegheny Mountains. It became known as the Central Free Dispensary in 1873. In 1864, St. Luke's Hospital was founded, and, in 1883, Presbyterian Hospital. All three institutions merged in 1956 to form Presbyterian-St. Luke's Hospital and Health Center. In 1969, Rush Medical College merged with the Hospital to create Rush-Presbyterian-St. Luke's Medical Center.

In 1885, the first antecedent of the College of Nursing, the St. Luke's Hospital Training School of Nurses, opened its doors to offer diploma education in nursing. In 1903, the Presbyterian Hospital School of Nursing accepted its first students and from 1956 until 1968, nurses were taught at the merged Presbyterian-St. Luke's Hospital School of Nursing. Before the establishment of the College of Nursing in 1973, a total of 7,221 nurses had graduated from these three schools. Many made outstanding contributions to the field of nursing.

The College of Health Sciences, established in 1975, is the newest academic component of Rush University. Its present elements include pre-existing basic science departments of the Medical Center, organized within the Office of Biological and Behavioral Sciences and Services; a number of departments of related health sciences, organized within the Office of Related Health Sciences; and finally, the Rush Graduate School.

The mission of the college is to exercise responsibility for the education and training of undergraduate students, graduate students, and postgraduate fellows in those degree programs which the faculty generates, from the baccalaureate through the doctorate. The college is also responsible for the continuing development of research programs, the application of new knowledge to improve health care, and the teaching of basic sciences in other colleges of the university. In all of its educational programs, the college is particularly committed to the concept that scientists and professionals in areas of health care other than medicine and nursing are also an integral part of the health care endeavor. Their education, therefore, is seen as central to the growth of a more successful system of health care delivery.

Today, Rush University continues to build upon its tradition of commitment to the education of future health care practitioners and to the establishment of a rational system for the delivery of care to all segments of the population. The university is fully accredited by the North Central Association of Colleges and Schools to offer programs leading to the baccalaureate, master's, and doctoral degrees. As an integral element of Rush-Presbyterian-St. Luke's Medical Center, Rush University is part of a cooperative health care delivery system that serves approximately 1.5 million people through its own resources and those of affiliated health care and academic institutions. At the Medical Center, more than $7 million is budgeted each year to carry out basic research and clinical investigation in traditional disciplines and in multidisciplinary areas, as well as in nursing and related health.

Campus and Student Life

The Campus

The College of Health Sciences, the College of Nursing, and Rush Medical College are located on the campus of Rush University at Rush-Presbyterian-St. Luke's Medical Center on Chicago's near west side. The Medical Center includes: Presbyterian-St. Luke's Hospital; the Marshall Field IV building, an outpatient mental health facility; research buildings where more than $7 million is budgeted each year to carry out basic scientific and clinical investigations; academic facilities for Rush Medical College, the College of Nursing, and the College of Health Sciences; a professional office building; apartment buildings; the Laurance Armour Day School for children of employees and students; and the Johnson R. Bowman Health Center for the Elderly. The Sheridan Road Pavilion on Chicago's north side is operated as an integral part of the Medical Center.

In September, 1976, the new Rush-Presbyterian-St. Luke's Medical Center Academic Facility was dedicated. The structure is the hub of activity of Rush University and accommodates large class activities, small group seminars, and individual instruction. The dean's and admissions' offices for most programs are located in this building. It has direct internal access to the Professional Building and patient care and research facilities. Involvement of students with faculty and staff at these adjacent facilities is an integral element of the academic programs at Rush.

The new building includes a large multidisciplinary laboratory surrounded by 10 unit laboratories. Each unit houses 16 student stations for basic science studies. A separate gross anatomy laboratory is designed on the same modular concept. A central demonstration area and model room is accessible from four dissecting modules, each with six tables. Two 150-seat lecture halls are designed to utilize all types of media presentations and live demonstrations. The Center of Educational Resources, which includes the library, the Learning Resource Center (equipped with 31 audio-visual study carrels), computer assisted instruction, biomedical communications, animal resource facilities, curriculum and evaluation, and general resources, supports all instructional activities for faculty and students.

The Library of Rush University, the oldest medical library in the city of Chicago, serves the entire university campus and is located in the new Academic Facility. It is administered by a staff of professional medical librarians. The library has approximately 80,000 volumes, subscribes to 1,400 periodical titles, borrows documents from interlibrary loan, and processes MEDLARS, MEDLINES, and AV-LINE requests for patrons. New monograph and reference books are acquired at a rate of over 2,000 each year. The library also has an outstanding collection of rare medical books available for research and study.

Schweppe-Sprague Hall houses lecture rooms, office space, student dormitory rooms, and a student recreation room. Student support offices and the bookstore for the university are on the first floor. The student counseling center is located on the 8th floor. The services of the Registrar of Rush University and the Offices of Student Financial Affairs, Student Affairs, Financial Aid and the Counseling Center are available to all university students.

Clinical Experience

Students of Rush University receive their clinical training primarily at Presbyterian-St. Luke's Hospital, a voluntary, not-for-profit hospital with a professional staff of about 900 physicians and scientists, 921 nurses, and 318 house staff who receive graduate medical education in over 30 specialty areas. Students also spend clinical time at other agencies and institutions in the Chicago area. Each year more than 27,000 patients are admitted to the hospital, which has 873 beds and 34 bassinets. By tradition each patient participates in the teaching programs of Rush University. The hospital is directly across the street from Schweppe-Sprague Hall.

In clinical settings, health science students are required to wear white laboratory coats.

Affiliated Hospitals

Affiliated hospitals and a community health center are cooperating with Rush-Presbyterian-St. Luke's Medical Center to provide students and house staff with opportunities to participate in the delivery of health care in a variety of socioeconomic settings in urban and rural areas.

Participating institutions are:

Bethany Hospital, Chicago:	165 beds
Central DuPage Hospital, Winfield:	359 beds
Christ Hospital, Oak Lawn:	830 beds
Community Memorial General Hospital, LaGrange:	276 beds
Galesburg Cottage Hospital, Galesburg:	210 beds
Grant Hospital of Chicago, Chicago:	508 beds
Schwab Rehabilitation Hospital, Chicago:	67 beds
Mount Sinai Hospital Medical Center, Chicago:	440 beds
Swedish Covenant Hospital, Chicago:	299 beds
West Suburban Hospital, Oak Park:	372 beds
Mile Square Health Center, Chicago:	more than 35,000 patients registered

Housing and Transportation

Chicago and its adjoining suburbs as well as the university, provide a wide variety of off- and on-campus housing options for Rush University students. The Office of Student Affairs publishes a "Housing Information Sheet" that outlines these residential opportunities in detail. This sheet is sent to all accepted students.

Schweppe-Sprague Hall, Kidston House, and McCormick House comprise the on-campus housing at Rush University. The individual units range from a limited number of single occupancy dormitory spaces to two-bedroom apartments that accommodate up to four students. With the exception of the dormitory rooms, all apartments are unfurnished. When filled to capacity, our current on-campus facilities can house approximately 25% of our total student body.

Nine month or twelve month rental agreements are available for on-campus housing and a security deposit equal to one month's rent is required in advance. A written notification of cancellation of the housing agreement by August 15 will result in a full return of the deposit to a student. After that date the deposit is nonrefundable for cancellation purposes. The deposit is returned to the student after the apartment is vacated, less the cost of repairing any damage to fixtures, walls, ceilings, or floors.

Applications for on-campus housing are available upon request from the Office of Student Affairs. Students willing to accept a roommate arrangement are given preference for the apartment units.

Information regarding current availability of off-campus units, potential roommates, and car pools also is coordinated by student affairs. The office maintains an off-campus housing bulletin board as well as current copies of the local newspapers to assist students with their relocation problems. All housing inquiries should be directed to:

Office of Student Affairs
Rush University
1743 W. Harrison Street
Chicago, Illinois 60612
(312) 942-6302

Public transportation to and from the Rush campus is readily available. The "Congress A" train from downtown Chicago and western suburbs such as Oak Park, stops two and one-half blocks northwest of the campus at the "Medical Center" stop. The "Douglas B" train from downtown, stops at "Polk Street" at the southeast corner of the campus. Chicago Transit Authority buses also stop at the campus. The Medical Center also operates a shuttle bus to and from the Chicago Northwestern and Union train stations during rush hours.

Rush students who commute by automobile may use the covered garage located directly across the street from the Academic Facility on Paulina Street.

Health Services

The university has authorized a two-part program of medical service to protect and promote the health of its students. One is Anchor, a health maintenance organization oriented toward illness prevention, which provides a variety of professional services and ambulatory care.

While a student is actively enrolled, single coverage in Anchor is provided at no charge. However coverage does not begin until an Anchor application is properly filled out and signed at the Office of Financial Affairs. A new application must be filled out during the first week of the quarter *for every new student* and whenever a student is rejoining the Anchor program after a lapse in coverage such as summer vacation.

In addition, students are required to stop by the Office of Financial Affairs prior to the end of spring quarter and indicate if they want continued summer coverage or not. If summer coverage is desired, they will be required to pay the appropriate fee at that time.

A student's spouse and dependents may also be enrolled in the Anchor program for an additional fee. This can be done by filling out a change in coverage card for family or couple coverage when the student first becomes married or has a child or at open enrollment during the first week of each quarter.

Costs for 1979-80 participation were:
(Per Quarter)

Anchor	While enrolled	Not enrolled
Single	—0—	$ 44.00
Couple	$ 44.00	$ 88.00
Family	$101.00	$145.00

The other program is the Blue Cross Hospitalization Insurance. Each student must maintain this Blue Cross coverage or its equivalent from the date of matriculation until graduation, including summer quarters. Prior to matriculation, students must decide to either join Rush's Blue Cross policy or obtain similar hospitalization coverage elsewhere.

During fall registration all students must sign up for single Blue Cross membership unless they can provide proof of alternative coverage. Such proof consists of presenting a current alternative hospitalization policy or a member identification card. After fall registration a student can only join Rush's Blue Cross policy at open enrollment during the first week of each quarter.

If during the school year a student wants to drop Blue Cross coverage, he or she must first show proof of similar coverage elsewhere and then can only drop at the end of the current quarter. In addition if a student does drop coverage, he or she can only reenroll during the first week of fall quarter.

A student's spouse and dependents may also be enrolled in Rush's Blue Cross plan for an additional fee. This can be done by filling out a change of coverage form for family coverage when the student first becomes married or at open enrollment during the first week of each quarter. A child is covered under the family plan at no additional charge, however the child's name must be added on the policy before the coverage is effective. This can be done by filling out a change of coverage form at the Office of Financial Affairs.

Costs for 1979-80 participation were:

Blue Cross	Per Quarter	Summer Plan
Single	$ 33.00	$ 33.00
Family	$151.00	$151.00

Students not enrolled in the university are ineligible for the university's Blue Cross coverage.

Counseling Services

At the Student Counseling Center, students with a range of emotional and social adjustment problems may obtain help from mental health professionals. The Center is a place to discuss study and learning difficulties, marital and relationship stresses, and any other

matters which may be hindering growth and development. In addition to individual and couple counseling, the Center offers group and workshop experiences. Concerns common to many students can often be addressed effectively by small group discussions. Also, the Center trains student volunteers as peer counselors. Members of the peer counseling group, the Inner Ear, are available for students who prefer to confer with another student rather than with a professional.

The Student Counseling Center maintains strict standards of privacy and confidentiality. No information on individual students is released to anyone, inside or outside the university, without the informed consent of the student, nor do student contacts with the Center become a part of University records.

Social and Cultural Activities

The more than 1000 students currently on the Rush University campus enjoy a variety of co-curricular activities. The Office of Student Affairs works with students to sponsor organized programs, including University Nights at local cultural events, on-campus entertainment and social gatherings, and a film series.

The Steering Committee is an elected group of students whose purpose is to assist in the administration of student elections to College and University Committees. These committees insure that students will have representation in formulating policies and procedures related to their needs.

The University Programming Board is an elected group of students from all three colleges who work with the Office of Student Affairs to plan and implement co-curricular programs. The group organizes regular student/faculty get-togethers, student dances, recreational, and other social and educational events.

Chicago's loop area, with its many opportunities to enjoy art, music, drama, films, and museums, is located approximately two miles from campus. It is easily reached by car or public transportation. Outstanding attractions in Chicago include the Chicago Symphony Orchestra, the Lyric Opera, the Art Institute, the Museum of Science and Industry, the Field Museum of Natural History, the Shedd Aquarium, and the Adler Planetarium. The Office of Student Affairs is often able to obtain tickets at reduced prices to many cultural attractions.

Lake Michigan provides an ideal site for a variety of activities such as swimming, boating, fishing, bicycling along the lake shore path, and sunning. During the winter months, ice skating and cross-country ski enthusiasts have access to Chicago's expansive parks.

Rush University expects to continue an arrangement for Rush students to use physical educational facilities at the University of Illinois Chicago Circle Campus. The fee structure and procedure for obtaining a pass will be announced in the fall quarter by the Office of Student Affairs.

Career Opportunities

Rush provides students with information concerning job opportunities. The Office of Student Affairs provides information on summer job opportunities particularly between the junior and senior years of the undergraduate program. The Office of Student Affairs coordinates a number of Career Fairs to acquaint students with job opportunities available at health care agencies after completion of the program. In addition, students can establish a permanent file with the Office of Student Affairs.

International Students

Rush University welcomes students from other countries and every effort is made to help the foreign student adapt to life in the United States.

The Test of English as a Foreign Language (T.O.E.F.L.) must be submitted if English is not the applicant's native language. Any evidence in support of the application must have an authorized English translation.

Graduate applicants from other countries

must successfully complete the proficiency examinations of the College of Health Sciences to determine skills and knowledge in subject matter.

Rush University is authorized under Federal law to enroll non-immigrant international students. Form I-20 will be issued at the request of the student after an offer of admission is made. International students must provide proof of ability to finance their entire education before the form will be issued.

Equal Opportunity

Rush University encourages and gives full consideration to all applicants for admissions and financial aid regardless of race, sex, creed, color, or national origin. Moreover, in furtherance of the nation's commitment to end discrimination on the basis of handicap and in accordance with the provisions of Section 504 of the Rehabilitation Act of 1973 and all regulations properly issued thereunder to protect the rights of handicapped persons, it is the university's policy that no person or activity administered by Rush University shall exclude from participation, deny benefits to or subject to discrimination, any qualified individual solely by reason of his or her handicap. Ms. Beverly Huckman, Equal Opportunity Coordinator for Academic Affairs, has been designated as the university's coordinator for implementation of these policies.

The College of Health Sciences

The following pages describe the departments and divisions of the college and its Graduate School; their research, educational, and service programs; and the policies and procedures governing student admission and progression.

Office of Biological and Behavioral Sciences and Services

Cecilia Brocken, Ph.D., Associate Dean

Departments

Anatomy	17
Biochemistry	20
Immunology	26
Microbiology	28
Pharmacology	31
Physiology	34
Psychology and Social Sciences	38

Department of Anatomy

Anthony J. Schmidt, Ph.D., Chairperson

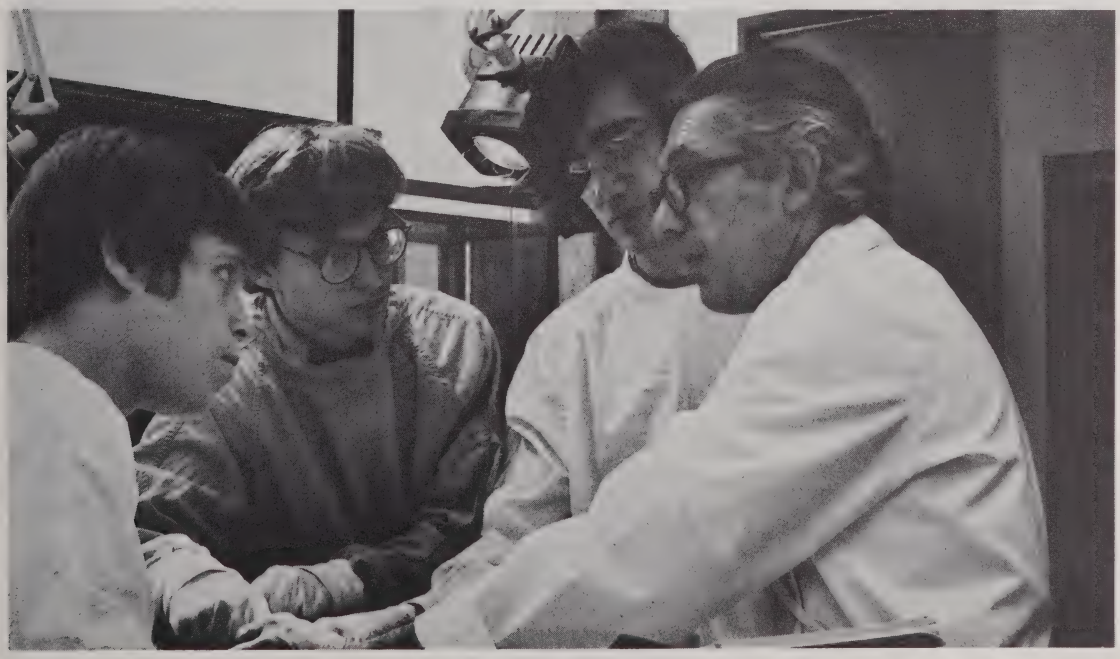
Faculty

Colgan, J.	Galante, J.	Khedroo, L.	Schmidt, A.
Dinsmore, C.	Hovde, C.	Khodadad, J.	Seale, R.
Durica,T.	Hughes, W.	Maibenco, H.	
	Jacob, S.	Martinek, J.	

Research Activities

The fundamental search of the anatomy faculty lies in elucidating the structure and function of cells, tissues, and organs composing the fabric of life of all living creatures. Investigations are conducted in such diverse areas as DNA synthesis during gestation in the reproductive system, formation of retinotopic projections to the optic tectum and neural plasticity in the chick visual system, corneal lesions and induced microcirculation, cell biology of normal and pathologic mammalian skeletal and cardiac muscle, repair mechanisms in the CNS, developmental morphogenetics, tissue-tissue interaction, induction and organogenesis, protein synthesis and other molecular studies in urodele appendage and spinal cord regeneration. These investigations employ such experimental approaches as surgical manipulations, light and electron microscopy, cryostat histochemistry, radioisotope labeling for autoradiography, spectrophotometric assay, electrophoresis and isoelectrofocusing procedures.

Interdisciplinary collaboration is encouraged, especially where clinical application may evolve from basic research. In particular, we currently participate in ongoing investigations into the biomechanics of human locomotion, and the problems of the lumbosacral region of the back conducted within the Gait Laboratory of the Department of Orthopedic Surgery. There is a continuing collaborative study into the neurobiology of the visual system in the Helen Regenstein laboratories within the Department of Ophthalmology. These and other affiliations bespeak the broad interest and research activities of the faculty.



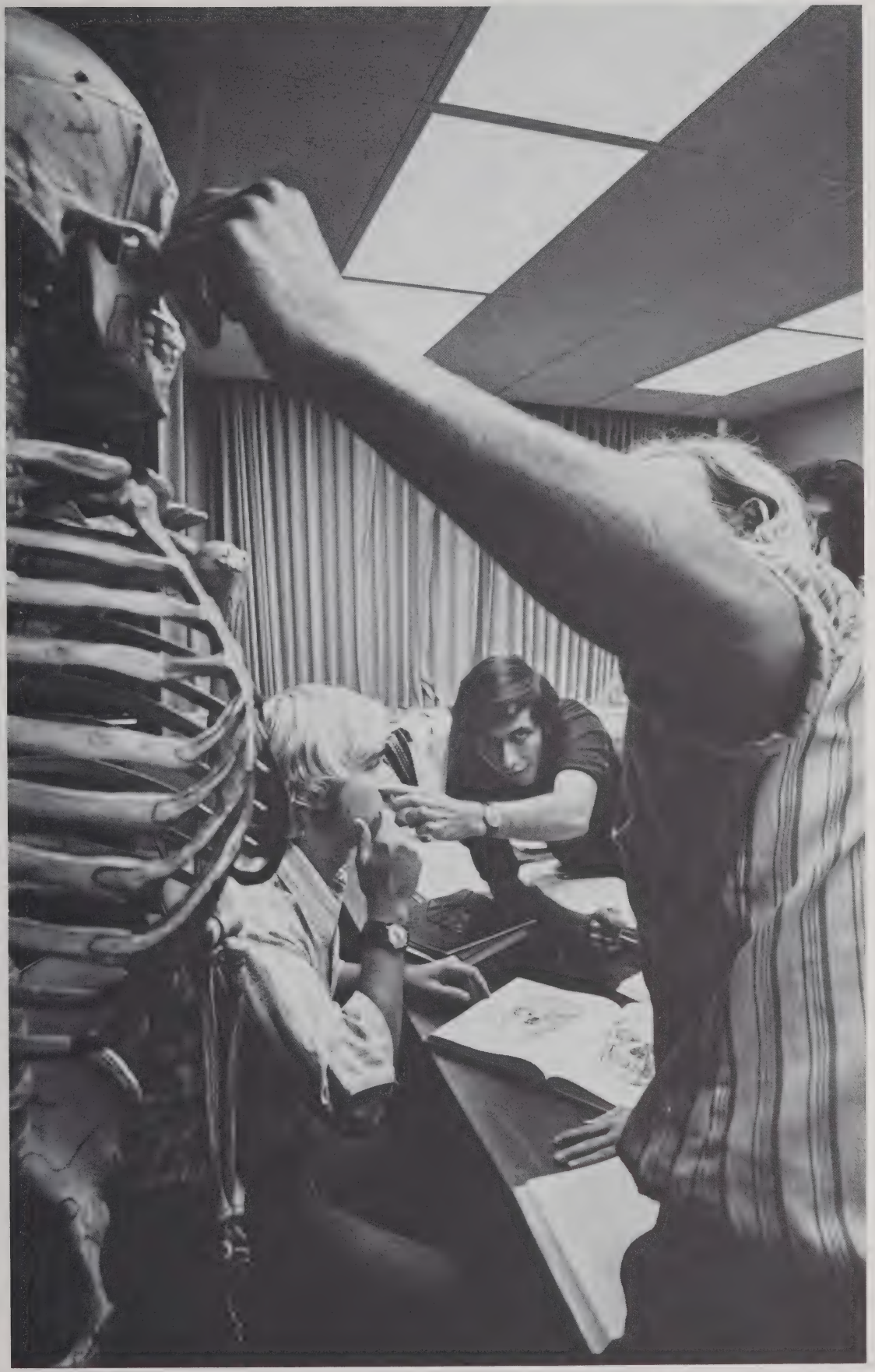
Educational Activities

The primary purpose of the anatomical sciences in our medical curriculum is to assist the student to develop a working concept of the morphology of the human body. The anatomical programs are instructive in the gross and microscopic architecture of the human body relevant to the body's functions and to its embryological origins. As a science, anatomy is fundamental to the health professions and its understanding is essential to the art of medicine.

To understand the structural details and complex relations of parts of the human body, the very basis of its activities, you must take it apart yourself. Therefore, a laboratory experience in the direct study of the human body is very important in anatomy (*anatome* = to cut up, Gr.). The student will devote much time in the laboratory dissecting a cadaver by region, gradually developing a personal conception and appreciation of the human body. To assist in this learning process, frequent reference is made to living anatomy and to clinical correlations. Lectures, preceptorials, and audiovisual aids serve to enrich the student's education.

The histological and ultrastructural organization of the human body is studied to develop a sound understanding of the microscopic architecture and functions of cells, tissues, organs, and systems. Though the inseparable relationship to the normal healthy structure and function of the body is evident, microscopic anatomy also is essential to recognizing the clinical pathologies of disease. A laboratory experience with microscope and prepared slides is an important part of the program, which includes coordinated introductory and conceptual lectures, and preceptorial discussions.

Neuroanatomy is taught as part of the neurobiology program in which sound concepts of the gross and microscopic organization of the central nervous system are essential to understanding functional neurology. In addition to lectures, students will have an opportunity to visualize the complexities of the CNS in the laboratory, where they will dissect the human brain and study specially prepared slides of the brain stem. Also, there are plastic embedded gross coronal sections, select models, and other audiovisual aids to assist in the learning process.



Department of Biochemistry

Hermann Mattenheimer, M.D., Acting Chairman

Faculty

Anderson, K.	Harris, L.	Kuettner, K.	Rafelson, M.
Bezkorovainy, A.	Harrison, W.	Kumar, S.	Sky-Peck, H.
Cohen, M.	Hayashi, J.	Lee, S.	Uhlenhopp, E.
Cole, E.	Hoskin, F.	Lobstein, O.	Weinstock, A.
Demidow, L.	Kachmar, J.	Mattenheimer, H.	Whisler, K.
Dubin, A.	Kornel, L.	Morley, C.	Whisler, W.
Gotterer, G.			

Research Activities

The members of the Department of Biochemistry conduct a broad range of independent research activities, which include collaborative research programs with investigators in other departments of Rush-Presbyterian-St. Luke's Medical Center, Mount Sinai Hospital Medical Center, the University of Illinois, Northwestern University, The University of Chicago, the Ames Company, and the Hektoen Institute for Medical Research. The diverse research interests of the faculty provide expertise in the areas of protein chemistry and functions, DNA metabolism and cell regulation, thrombosis, cartilage structure and metabolism, neurochemistry and the aging process, enzymology, hormone metabolism, cancer metabolism, and immunity.

The overall research programs consist of projects in these general areas and are briefly described below.

Biochemistry of Bone and Connective Tissues: One biochemistry program in collaboration with the Department of Orthopedic Surgery involves studies on the molecular organization of the extracellular cartilage matrix. Epiphyseal cartilage is both avascular and non-calcified. Shortly before this cartilage is replaced by bone, it calcifies and becomes invaded by capillary sprouts. Accompanying these two changes, a series of events occurs that culminates in the resorption of the calcified cartilage matrix and the formation of bone. We have been particularly interested in the smaller molecules in this tissue and have now isolated and partially characterized two such biologically active molecules, lysozyme and a cationic protein that acts as a protease inhibitor. Each appears to play an important role in the metabolism of cartilage. The molecular arrangement of proteoglycans in a very specific aggregated state has been shown to be involved in the inhibition of calcification. We have been able to show that mammalian lysozyme plays a role in governing this "state of aggregation" of matrix proteoglycans and therefore may regulate cartilage calcification. Since aggregated proteoglycans seem to be diminished in the osteoarthritic cartilage matrix and lysozyme is both elevated and present in an active (uninhibited) form, it can be implicated in the etiology of degenerative arthritis.

In addition, another aspect of this study deals with the role of the protease inhibitor that this laboratory discovered in cartilage, aorta, and other connective tissues. Cartilage is one of the few tissues in the body that lacks a capillary blood supply. Clinicians and pathologists, however, have long shown that cartilage also is rather resistant to invasion by both inflammatory and neoplastic processes. We were able to show that normal human skin as well as endothelial cell-derived collagenase is inhibited by the cartilage-derived protease inhibitor. We extended these studies to neoplasms and found that both human osteosarcoma cells and primary and metastatic mammary carcinomas can be stimulated to secrete a tumor collagenase. This collagenase also is inhibited by the cartilage-derived low molecular weight protein.

Anti-Tumor Invasion Factors Derived from Cartilage: Since cartilage is a "non-permissive" tissue to "normal" and pathologic invasion, we suggest that the inability of cells to encroach upon cartilage may be due to the endogenous specific inhibition within its matrix. If it is hypothesized that invasiveness of a tumor is related to the degree of collagenase production, then it is possible that invasiveness can be regulated by the presence or absence of anti-collagenolytic substances such as specific collagenase

inhibitors. Based on our current data, we hypothesize that the resistance of cartilage to penetration by endothelial cells (capillary in growth) as well as invasion by neoplastic cells at least in part is due to specific tissue protease inhibitors. Work is in progress to prove these hypotheses.

Human Milk Proteins: Research reports have described the isolation of a number of glycoproteins with *L. bifidus* growth-promoting activity. During the past year, in an attempt to simplify the isolation procedure for these glycoproteins, the so-called proteosepeptone fraction of human milk was prepared by the method used for the preparation of the analogous fraction from bovine milk. Though the proteose-peptone fraction components of bovine milk are related to casein, the human materials were found to be of whey protein origin. The main component of this fraction was **a**-lactalbumin, and additional components included the small molecular weight glycoprotein previously isolated (as expected), and a so-called "temperature-sensitive protein." This interesting protein precipitated at room temperature and went back into solution at 4°C. It had no carbohydrate, but contained phosphorus. Its amino acid complement was very heavy in proline and glutamic acid, and bore some similarity to that of **b**-casein. It was hypothesized that the temperature-sensitive protein was really one of the **b**-casein phynotypes.

Iron Metabolism: The research investigation of iron metabolism was previously focused on the interaction of transferrin with immature red cells. The specific transferrin receptor from the cell surface was purified and characterized. Its molecular weight (minus the transferrin) was near 110,000, and it consisted essentially of a subunit with a molecular weight near 49,000, three subunits with a molecular weight of 17,000 each, and a lipid component accounting for some 5% of the total receptor weight. It contained nearly 10% carbohydrate.

Focus has now shifted from the erythroid cell physiology to the interaction of iron with liver cells. Isolated rat hepatocytes were prepared and incubated with various forms of iron: ferric iron-citrate complex, ferrous iron, and transferrin-bound iron. Using the Michaelis-Menten kinetic approach, it was found that ferrous iron uptake was fastest, but the iron was taken up by a simple diffusion process. The uptake of ferric iron was slower, and showed saturation kinetics. Transferrin-bound iron was taken up the slowest, and this also showed saturation kinetics. The uptake of transferrin-bound iron was increased when the collagenase solution used for the perfusion of the rat liver contained soy-bean trypsin inhibitor. This finding prompted us to postulate that the uptake of transferrin-bound iron by the liver involves the interaction of the iron-transferrin complex with the specific receptor on the hepatocyte cell surface. It would appear that the uptake of iron by the hepatocytes is not unlike that of reticulocytes.

Humoral Regulation of Liver Cell Growth: Humoral factors, including known hormones such as insulin, glucagon, and hydrocortisone are capable of affecting the rate of DNA synthesis in hepatocytes and may be involved in the regulation of liver cell growth.

The present studies represent an extension of previous work in which an identified heat–stable nondialyzable polypeptide RF_1 was found in the serum of rats following partial hepatectomy that was specific for stimulating DNA synthesis in hepatocytes.

Specific immediate aims were 1) to study the role of the hormones, insulin, glucagon, and hydrocortisone on adult liver cell proliferation in culture, and 2) to study the effect of RF_1 on ornithine decarboxylase (a possibly growth regulatory enzyme) and tritiated thymidine uptake into DNA in cell cultures of adult hepatocytes.

A primary monolayer hepatocyte culture system has been established that enables both normal and regenerating rat liver cells to be maintained in culture with a viability of over 80% for 5 days. This cell culture technique was used in the assay of serum factors and hormones involved in the initiation of DNA synthesis and cell proliferation *in vivo*.

Cells isolated from a rat liver 12 hours after partial hepatectomy before the time of onset (14 to 16 hr.) of DNA synthesis *in vivo* would not enter DNA synthesis in culture. Cells

isolated during the period of active DNA synthesis *in vivo* (24 hours post partial hepatectomy) continue that round of DNA synthesis *in vitro*.

It therefore appears that regenerating cells must be committed to or already in the S phase of the cell cycle *in vivo* in order to undergo DNA synthesis in culture. The role of the factors that initiate DNA synthesis in hepatocytes now can be determined using this cell culture system. The latter population in particular would be expected to be sensitive to the addition of hormones or other agents that are normally missing in the culture situation but are present *in vivo*.

Using normal liver cells in culture for up to 5 days we have tested the effect of hormones on the initiation of DNA synthesis. The combination of insulin and hydrocortisone significantly increases the extent of DNA synthesis in these cells. In contrast, we have been unable to show any effect of these hormone combinations on 16 to 17 hour regenerating liver cells even over a period of 48 hours in culture.

Cerebral Decline in Aging: The effects of aging on the dynamic metabolic process of brain tissue have not been clarified for the human or any other mammalian species. One difficulty has been distinguishing the effects of age–related abnormal cerebral circulation from those of abnormal cerebral metabolism. The circulation effects are being circumvented by studying the metabolic performance of isolated brain tissue (slices), using mice (CBF_1) as the animal model. It has been observed that there is significantly less oxygen uptake and $^{14}CO_2$ production in old (ca. 34 months) as compared to young (ca. 6 months) mice in brain slice incubations utilizing ^{14}C-glucose as the energy source. In this ongoing project, attempts are being made to identify the reactions that underly the effects found in tissue of aging animals. Being measured is the time course of formation of energy metabolites and key intermediates of carbohydrate and amino acid metabolism in brain slices of young and aging animals. Attempts are being made to locate the defective sites in aging tissue by employing energy sources that feed into carbohydrate metabolic pathways at different levels. Also, we will measure the synthesis of selected neurotransmitters in brain slices derived from the young and old animals in an attempt to correlate their dynamic metabolism with the dynamic metabolic state of the tissue. Selected correlated *in vivo* experiments are being done to validate the results. All tissues studied are being characterized with respect to the presence and concentration of lipofusein, RNA, and DNA to enable their correlation with the metabolic abnormalities found. The study will provide clues as to how the metabolic defects give rise to functional abnormalities. It is anticipated that the study will contribute to the understanding of mental dysfunction in aging humans and may suggest new ways to treat the elderly.

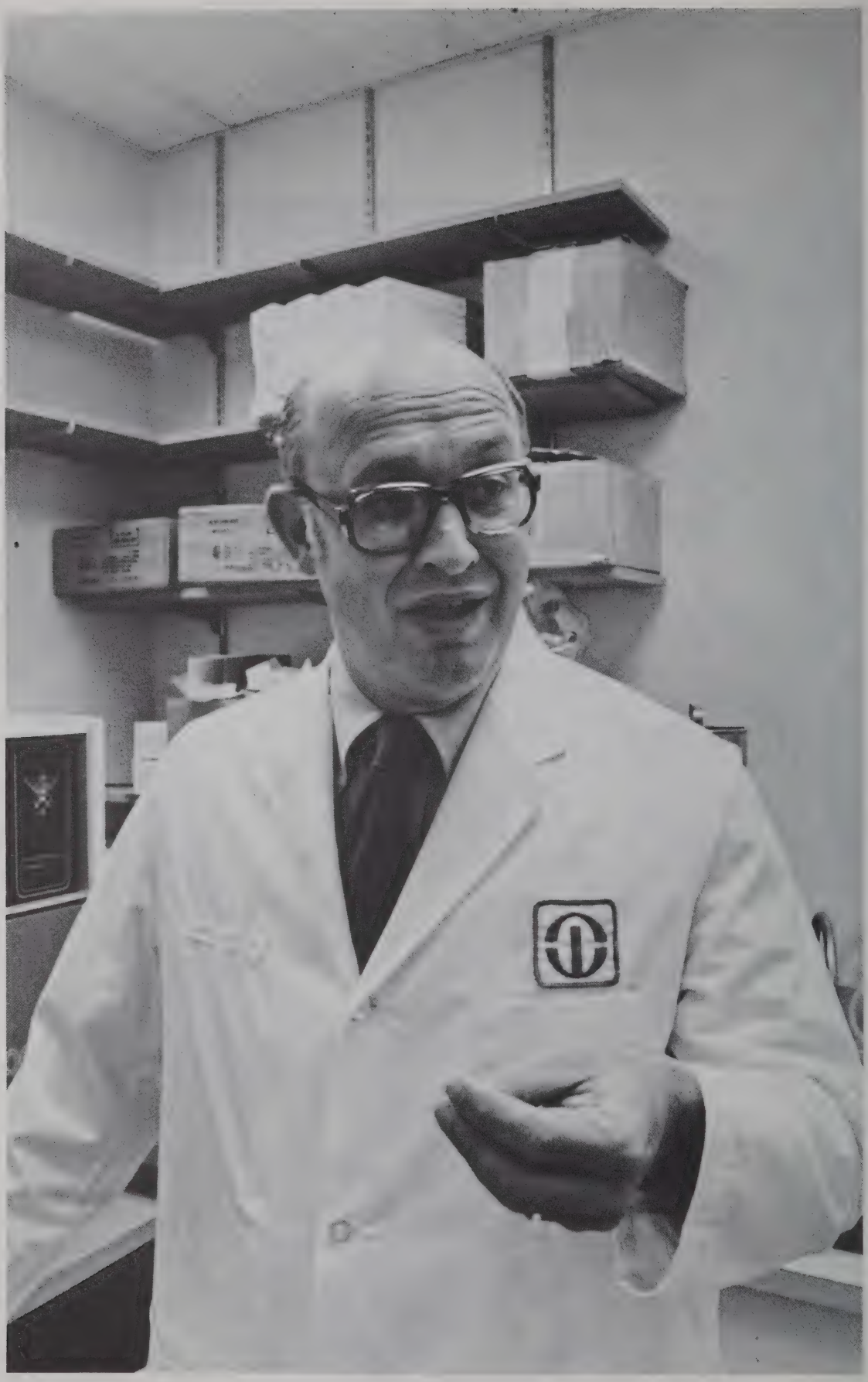
Study of Plasminogen Activators: The fibrinolytic mechanism is one of the last lines of defense against the permanent occlusion of blood vessels by fibrin thrombi. The endothelial cell layer of vessels is thought to be the source of a plasminogen activator that 1) maintains a normal level of activator activity for the lysis of fibrin that arises from physiological activation of the coagulation mechanism by minor trauma, and 2) is released in larger amounts in response to blood vessel injury and the formation of fibrin thrombi. This plasminogen activator has been isolated from pig heart in a highly purified state. However, when it is compared to the plasminogen activating potential of urinary urokinase, the activation of purified human plasminogen is much less rapid and complete than that achieved with urokinase. Recent studies have shown that another protein is essential for rapid activation. This protein, which is non-enzymatic, accelerates activation of plasminogen by tissue activator and has been termed accelerator protein (AP). During purification of activator, AP is apparently dissociated from activator, resulting in an activator of low proteolytic and esterolytic activity. Recombination of AP and activator results in a partial regain of proteolytic and esterolytic activity. Studies are continuing to determine the physicochemical properties of AP and its physiological role in the fibrinolytic mechanism.

Educational Activities

Members of the biochemistry department participate in basic science and medical education programs within the department and in conjunction with interdisciplinary programs. This participation takes place at many levels of education, including undergraduate and pre- and post-doctoral programs. The department participates in the teaching of basic and applied medical biochemistry to medical students of Rush Medical College during the three phases of the curriculum; the training of medical technologists in clinical chemistry in the Medical Technology Program of the College of Health Sciences; and the education of graduate students leading to a doctor of philosophy degree in the Graduate School. The department also uses the clinical biochemistry laboratory and research laboratories in training medical, basic science, and postgraduate students. Since the clinical laboratory is one of the most active up-to-date laboratories in the country, it provides opportunity for the teaching of medicine and for the training of clinical chemists. In addition, the department participates in seminars, rounds, and multi-disciplinary training programs.

Service Activities

The clinical biochemistry laboratory is a modern, automated, computerized, high-volume medical service facility performing approximately 1,700,000 individual chemical tests per year. These include some 250 different biochemical tests from the more simple electrolytes, carbohydrates, and fats to the more complex proteins, metabolites, and drugs. The objective of the clinical laboratory is to provide the most efficient, accurate, and extensive patient service obtainable. To accomplish this, the laboratory is continually studying the development of its automated and computerized facilities, quality control programs, methodology, and on-the-job training of personnel. Finally, it is the objective of the members of the clinical biochemistry laboratory that the facilities be used for the development of medical research, not only for patient services; as a teaching tool for medical students, house staff, and graduate students; and for a better understanding of human biology at the clinical level.



Department of Immunology

Henry Gewurz, M.D., the Thomas J. Coogan, Sr., M.D., Chairperson

Faculty

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Edwards, K.	Golden, H.	Hyde, J. S.	Luskin, A.	Plate, J.	Thomas, L.
Fiedel, B.	Hansen, B.	James, K.	Merkel, F.	Potempa, L.	Venkataraman, M.
Gewurz, A.	Harris, J.	Jones, J. V.	Mold, C.	Sassetti, R.	Zeitz, H.

Research Activities

The primary investigative interests of this department include: the immunobiology of the inflammatory response; mechanisms of cell damage and membrane alteration; the clinical, developmental, and experimental biology of the effectors of the immune response, particularly the complement system; cell-mediated mechanisms in inflammation; clinical and experimental biology of the allergic response; pathogenesis and immunobiology of amyloid; mechanisms underlying the allergic response; immunopharmacology; the chemistry, biology, and clinical relevance of C-reactive protein and the acute phase response, and their interrelationships with the immune systems in health and disease.

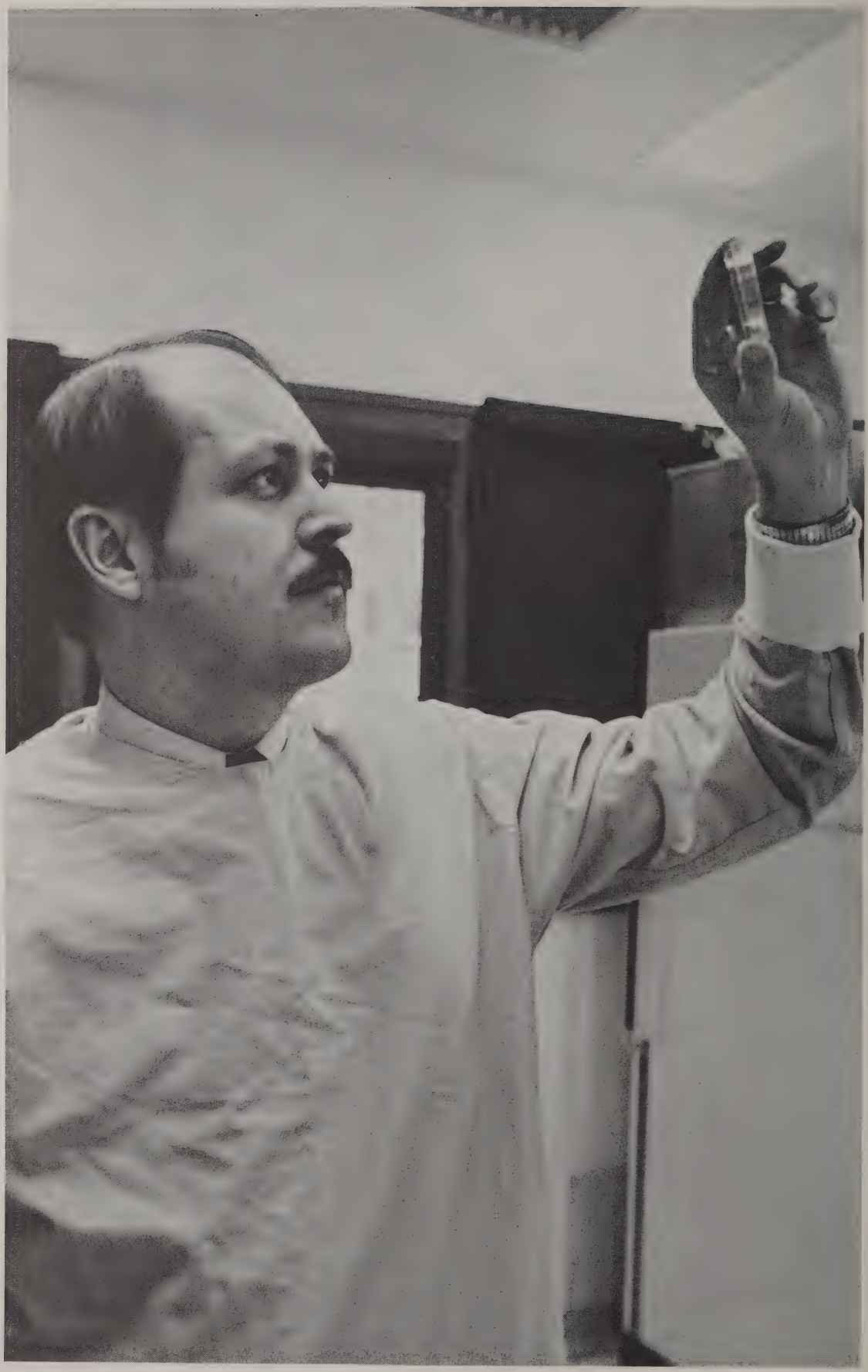
The application of basic research to questions of human health in disease is a major area of emphasis. This involves the innovation and implementation of new approaches that utilize analysis of the immune status and immunoassays to aid in the rapid diagnosis and treatment of disease, and analysis of individual patients and groups of patients with unique primary or secondary abnormalities or aberrations of the immune systems. The department is well equipped with both teaching and laboratory facilities for research in experimental and clinical immunology. Department members publish extensively and the faculty has been broadly represented at the annual meetings of national societies of immunology, pathology, pediatrics, and medicine, as well as at specialty and Gordon conferences. Active, productive collaborations continue with investigators at many other institutions. The activities of individual programs are summarized in the annual research report of the medical center.

Educational Activities

The department offers courses in basic immunology, allergy, and clinical immunology to medical, graduate, and related health science students, and postgraduate courses in allergy and clinical immunology to house staff and faculty. Weekly research seminars, clinical conferences, journal clubs, and ward rounds are held. Sixteen graduate students currently are preparing for the Ph.D. degree in our laboratories. A student research program has involved upwards of ten medical and undergraduate students during the summer, and upwards of six individuals during the year. The department generally has two to four postdoctoral fellows training in basic and clinical immunology. A two-year training program in allergy and clinical immunology involving two new fellow trainees each year recently has been established; in addition, more than thirty medical residents and fifty medical students receive training in allergy and clinical immunology in this program.

Service Activities

The clinical immunology laboratory provides patient services that include (a) assays to measure the competence of the immune system and the presence and nature of given immune-mediated diseases, disease processes, and host responses; and (b) the use of immunologic methods to quantify host proteins as well as certain medications. Our laboratories perform more than 100,000 immunoassays each year, and have pioneered in the development of individual and group tests. Our laboratories also are responsible for the training of many individuals at the student, resident, fellow, post-doctoral, and laboratory director levels, and have aided in the detection and reporting of numerous individuals with distinctive abnormalities of the immune systems. Patient care and consultative services in allergy and immunology are an integral part of the departmental activities; more than 3,000 patients are seen each year.



Department of Microbiology

Lauren G. Wolfe, D.V.M., Ph.D., Acting Chairperson
William Landau, Ph.D., Director, Section of Bacteriology

Faculty

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Goldin, M.	Levin, S.	Perry, E.	Welsh, T.
Goodheart, C.	Marczynska, B.	Peterson, D.	Wildra, A.
Jones, C.	McQuay, R.	Schechter, E.	Wolfe, L.

Research Activities

The research program includes studies of viral and chemical carcinogenesis, viral hepatitis, slow (virus) infections, persistent rubella virus infections, peridontal disease, campylobacter infections, and methodology in diagnostic microbiology.

Carcinogenesis: Oncogenic RNA viruses (oncornaviruses) and lymphotropic herpesviruses of primate origin are evaluated for transforming potential *in vitro* and oncogenicity *in vivo*. Cell susceptibility, mechanisms of transformation, and viral gene expression are investigated *in vitro*. Attempts to isolate or identify oncogenic viruses from spontaneous human and nonhuman primate tumors are pursued. Eight experimental tumor models (3 sarcoma, 1 glioma, 4 lymphoproliferation) have been established in marmoset monkeys and selected models are investigated from the standpoints of pathogenesis, viral gene expression, host immune response, and efficacy of therapy or prevention. Studies of chemical carcinogenesis and viral-chemical co-carcinogenesis in primate cells are under way.

Viral hepatitis: Experimentally-induced hepatitis A and non A-non B hepatitis are studied in marmosets. With non A-non B hepatitis attempts are under way to identify the etiologic agent(s) and to identify specific antigenic and serologic markers of infection. Cell cultures are examined for susceptibility to hepatitis viruses.

Slow (virus) infections: Kuru and Creutzfeldt-Jakob disease were transmitted to marmosets and studies of pathogenesis continue. Pathogenicity of mutant or defective measles viruses is studied in nonhuman primates, the aim being to develop a model of subacute or chronic CNS disease induced by measles virus.

Persistent rubella virus infections: Studies are under way to test the hypothesis that persistent latent infection with rubella virus plays a role in the etiology of some forms of rheumatoid arthritis. Antibodies to rubella virus were significantly elevated in a sample of rheumatoid patients, and a cell membrane antigen that may be specified by the rubella virus genome was detected on rheumatoid synovial cells by cytotoxicity tests with monospecific rubella virus antiserum.

Periodontal disease: The microbial components of subgingival plaque associated with various stages of periodontal lesions are studied. Emphasis is placed on the analysis of end products of organisms and definition of the bacterial products associated with pathogenicity.

Campylobacter infections: Spontaneous and experimental simian models of campylobacter infections are studied, for defining aspects of pathogenesis and host-parasite relationships that may contribute to a better understanding of human campylobacteriosis. Studies to develop serologic methods of diagnostic value in human infections are pursued.

Clinical microbiology: Developmental research in clinical microbiology is aimed at development and/or refinement of diagnostic methods for use in the diagnostic bacteriology and virology laboratories.

The research laboratories are well equipped for biological and biochemical research. Through the courtesy of the city of Chicago and the Chicago Board of Health, space is provided at the Municipal Communicable Disease Hospital for maintenance of a marmoset colony (approximately 1,000 animals) and for laboratory support.

Educational Activities

Diagnostic procedures and clinical background in bacteriology, virology, mycology, and parasitology are presented to medical technology students.

Classification, characteristics, laboratory identification, and pathogenicity of infectious agents are presented to medical and graduate students. The opportunity to experience laboratory work in diagnostic bacteriology, diagnostic virology, and virus serology is provided.

A three-month rotation through the diagnostic bacteriology and virology laboratories is available as part of the residencies in internal medicine, surgery, and pathology.

Service Activities

Clinical diagnostic services in bacteriology, mycology, parasitology, and virology are provided by a highly competent staff operating in a modern, computerized laboratory setting. The clinical microbiology laboratories function in support of patient care at the Medical Center and serve as referral and/or reference laboratories for network hospitals and other hospitals in the Chicago metropolitan area. Personnel in the clinical microbiology laboratories perform approximately 150,000 test procedures per year. Consultative services and continuing education programs are provided to students and staff. Developmental research in methodology is emphasized and areas of applied research are pursued as collaborative studies.

Department of Pharmacology

Paul E. Carson, M.D., Chairperson
Donald S. Ebersman, Ph.D., Director, Section of Pharmaceutical Sciences
Henri Frischer, M.D., Ph.D., Director, Section of Blood Genetics and Pharmacogenetics

Faculty

Boyd, E.	Gdalman, L.	Nausieda, P.	Rieckmann, K.
Carson, P.Boyd, E.	Klawans, H.	Nootens, R.	Trenholme, G.
Denbo, J.	MacLeod, C.	Nora, M.	Weiner, W.
Ebersman, D.	Maggini, G.	Parkhurst, G.	
Ecanow, B.	McKenna, R.	Powers, R.	
Frischer, H.	Moon, B.	Prancan, A.	

Research Activities

Research is conducted on the pharmacokinetics of drugs, especially as related to individual variation in drug response determined genetically, acquired, or by interaction with other drugs or their metabolites. This work requires continued development of methods for measuring drugs in the blood, urine, and other body fluids or tissues. This approach also will require ascertaining the pharmacology profile of individuals in terms of the activities of those reactions known to change drug metabolism, such as fast and slow acetylation, variation in detoxifying enzymes, or variations in enzymes such as G6PD deficiency that alter the response to drugs. In this context investigation of cellular metabolism especially of red cells as affected by drugs and the metabolites of drugs is conducted not only in terms of the enzymic pathways of the cells but also with respect to membrane effects on the cytoplasmic enzymes.

Research conducted by the Section of Blood Genetics and Pharmacogenetics includes the clinical and laboratory investigation of hereditary blood disorders, with particular emphasis on the detection, physiopathology, host- drug interactions, and treatment of oxygen and thiol metabolism in those with red cell enzymopathies, hemoglobinopathies, leukocyte and platelet disorders.

In the field of neuropharmacology, research is conducted on the pharmacology and biochemistry of animal models of human movement disorders coupled with investigations into the mechanism of action of drugs used in the therapy of neurologic and psychiatric disorders.

Other areas under active investigation include the clinical pharmacology of the aminoglycosides, the role of prostaglandins in endotoxin shock and in platelet aggregation, and the relationship of "tranquilizing" agents used in anesthesia to the analgesia induced by opiated derivatives.

Educational Activities

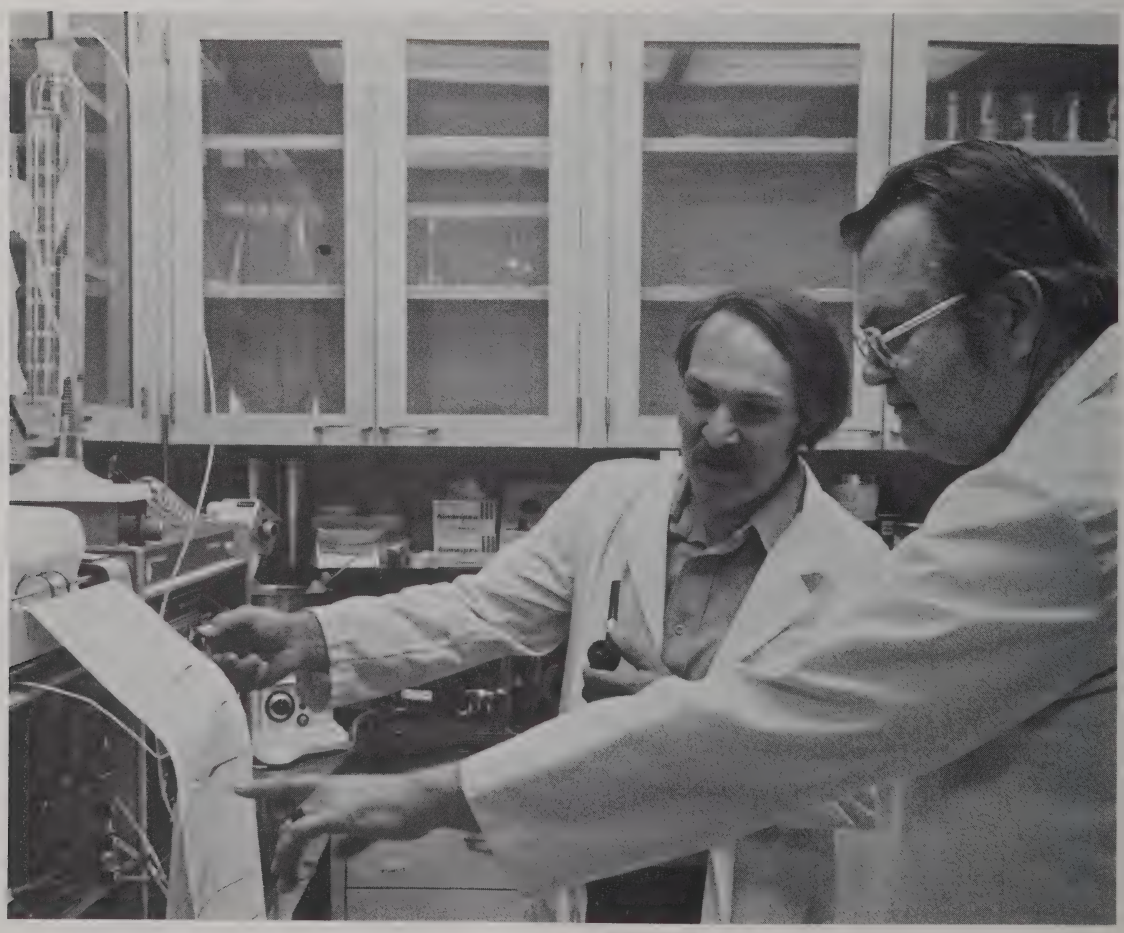
The Department of Pharmacology is responsible for teaching the sequences in basic pharmacology to students in Rush Medical College and the College of Nursing. The course in medical genetics for Rush Medical College is provided by the Section of Blood Genetics and Pharmacogenetics. Within the department, the Division of Pharmacology in the Graduate School of the College of Health Sciences is responsible for the graduate program leading to the Ph.D. degree in pharmacology. The department also offers elective experience both in laboratory research and in clinical pharmacology for third and fourth year medical students. Continuing education programs for house staff, nurses, pharmacists and attending staff are being developed.

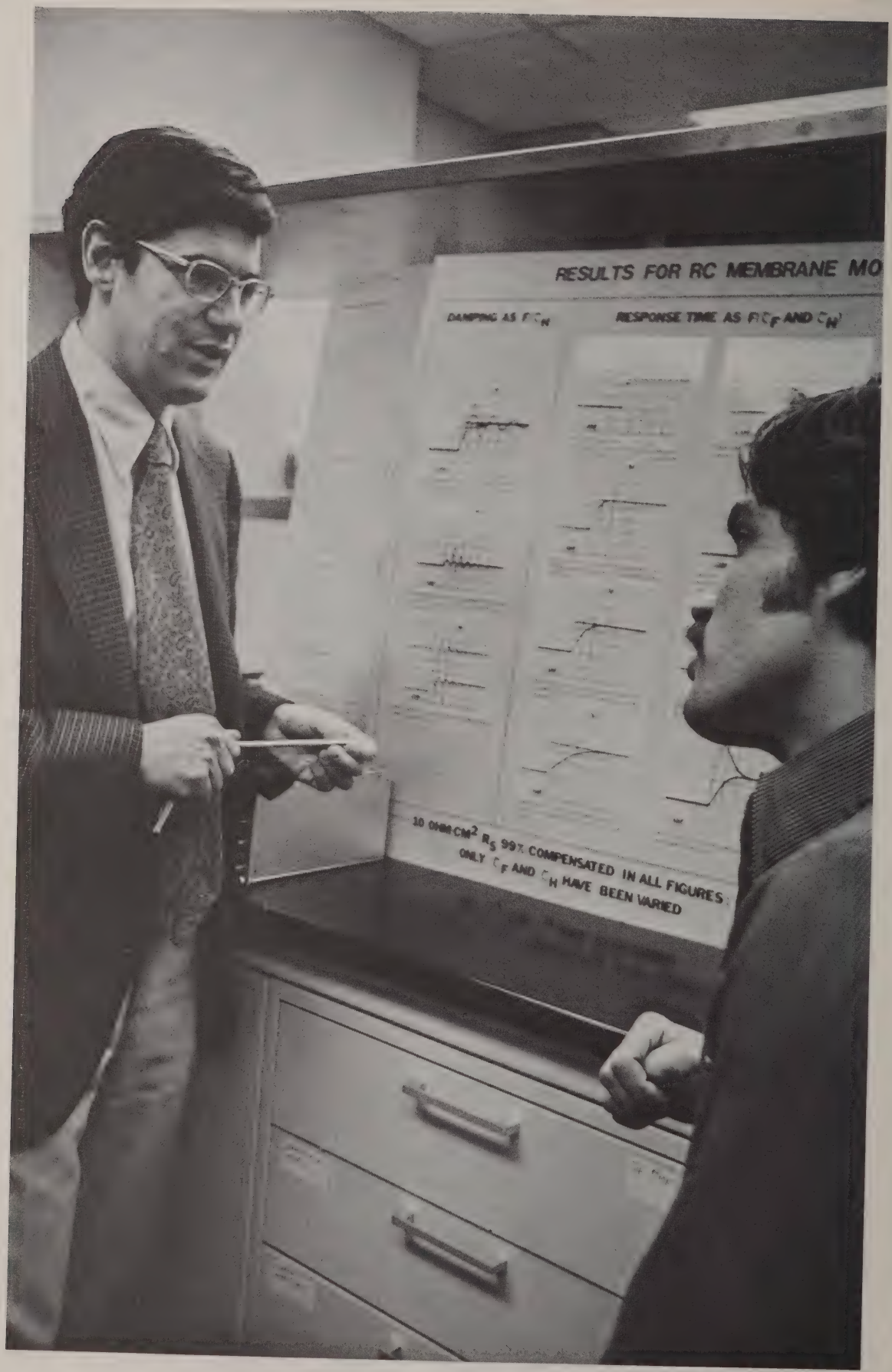
Clinical and Service Activities

Laboratory service includes determinations and the development of determinations of blood, urine, and tissue levels of drugs and their metabolities for the patient population of the Medical Center. Laboratory services also are provided to improve detection and management of inherited blood disorders and drug-induced disturbances.

The Section of Pharmaceutical Sciences includes the Medical Center pharmacy system, i.e., the hospital pharmacy, satellite pharmacies, and the pharmacies of the Sheridan Road Pavilion and the Johnston R. Bowman Health Center for the Elderly, and the RPSLMC Poison Control Center.

The Department of Pharmacology operates the Clinical Pharmacology Unit for designing and conducting studies to evaluate the effectiveness and safety of drugs. Facilities include specialized equipment for monitoring physiologic and metabolic functions of participating volunteers and patients as well as dormitory facilities for overnight studies when needed. In conjunction with the research, educational, laboratory and pharmaceutical facilities of the Department of Pharmacology, establishment of the Clinical Pharmacology Unit also provides a basis for clinical consultative services and programs for drug surveillance and drug reactions.




RESULTS FOR RC MEMBRANE MO
DAMPING AS F(C_H
RESPONSE TIME AS F(C_F AND C_H)
10 OHM-CM² R_S 99% COMPENSATED IN ALL FIGURES
ONLY C_F AND C_H HAVE BEEN VARIED

Department of Physiology

Robert S. Eisenberg, Ph.D., the Francis N. and Catherine O. Bard Chairperson

Faculty

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Cohen, F.	Gottlieb, G.	Lewis, C.	Schauf, C.
Donaldson, S.			Zimmerman, R.

Research Activities

Physiology is the study of function and mechanism of function of the various components of plants and animals. Physiological questions are asked of tissues at every level of structural complexity, ranging from questions of human behavior (how does a conscious human control the position of his foot?), to questions of the physics of ion movement (how does an ion cross a membrane 80A thick?). Such physiological questions, if intelligently asked, have direct relevance to practical issues of health and disease because some disease processes depend directly on the function of both gross and submicroscopic structures. Physiological questions have a unity because the methods of describing and analyzing function are *not* diverse, even if the structures performing those functions are. For example, the mathematics describing the flow of several ions across membranes is intimately related to the mathematics describing the control system that governs the movement of the foot.

The unity of physiology arises then from the questions it asks. The diversity of physiology arises from the systems about which those questions are asked. The excitement of physiology arises from the tension between its unity and its diversity. One never knows when the diversity (in the form of a new system being studied) will require new questions; questions when applied to previously studied systems are at least as revealing as when applied to the new system itself.

Considerable effort is spent in the department studying membrane phenomena since so much of the function of animals is directly traceable to the function of their membranes. Work is being done on the physics of ion transport across artificial membranes, which mimic the structure of the simpler parts of biological membranes. Work is also being done to extract the functionally important parts of biological membranes and place them into artificial membranes in which their biological functions will be directly accessible to the powerful techniques of physical and chemical analysis. The three membrane processes best understood today are the mechanism of ion transport across the membranes of red blood cells, the mechanism of ion movement that produces the electrical signalling within one nerve cell, and the mechanism of ion movement that allows one nerve cell to 'talk' to another. Significant research efforts are underway in each area.

The molecular properties of the transport system that maintains the volume of red blood cells and allows them to exchange oxygen with tissues are being examined with the use of pharmacological probes, digitalis, and related compounds. The mechanism of ion movement across nerve membranes is studied by controlling the driving forces across those membranes (namely, voltage and concentration) and examining the resulting currents. Such studies are underway in giant axons of marine worms (in which molecular questions can be asked) and in the more complex giant nerve cells of snails (in which processes well defined in molecular terms are being sought). The processes in axons of marine worms are essentially identical to the signalling processes in mammalian nerve fibers; the processes in nerve cells of snails are essentially identical to processes in various mammalian nerve cells. The mechanism by which one nerve communicates with another depends on the mechanism by which chemicals (e.g. numerous clinically useful drugs) influence voltages across membranes. The molecular architecture of the chemical receptors of nerve cells is being studied by recording the interaction of *single molecules* of drugs with those re-

ceptors. This latter work has already shown that the questions historically asked are poorly posed; it is now formulating its own questions, which undoubtedly will be immediately asked of nerve cells and pharmacological receptors in general.

As appealing as are the molecular questions just described, they clearly cannot be asked of all systems. Before a molecular question can be well posed, it must be clear how a single molecule is involved in the function of interest. Much of the work in the department is designed to isolate those systems that underlie fairly complex function and to isolate those systems in such a manner that it is sensible to ask molecular questions. For example, the molecular mechanisms that underlie the signalling system of skeletal muscle, cardiac muscle, and probably smooth muscle, are hidden from experimental view in membranes deeply enfolded within the muscle cells. It is worthwhile to isolate the molecules of the signalling system because those molecules are responsible for much of the function of the system, and for many of the failures of the system in disease (e.g. in muscular dystrophy). Molecular systems can be isolated only after a systematic procedure that examines the structure of the tissue, using quantitative anatomical techniques, that predict the properties expected from those structures, and using mathematical techniques that confront those predictions with the actual measured properties of the tissue. This procedure is being applied to skeletal muscle, cardiac muscle, and the lens of the eye.

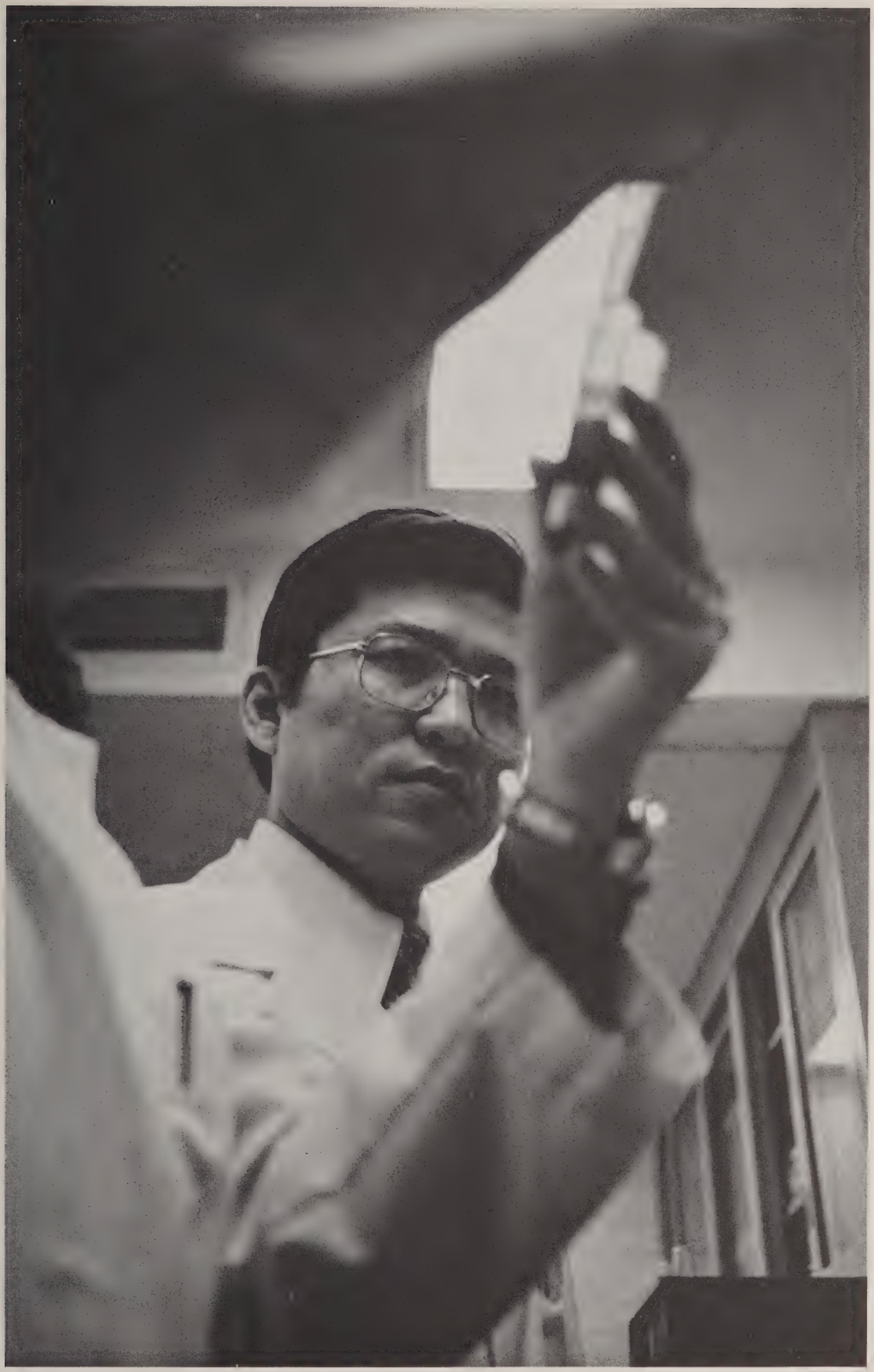
The behavior of more complex structures is being pursued as well. The processing of visual information in the retina is being examined in normal and pathological situations. The control of movement in conscious humans is amenable to a surprisingly precise and simple analysis. This control mechanism is being extensively investigated and the results applied to predict the movement of the foot under a variety of conditions.

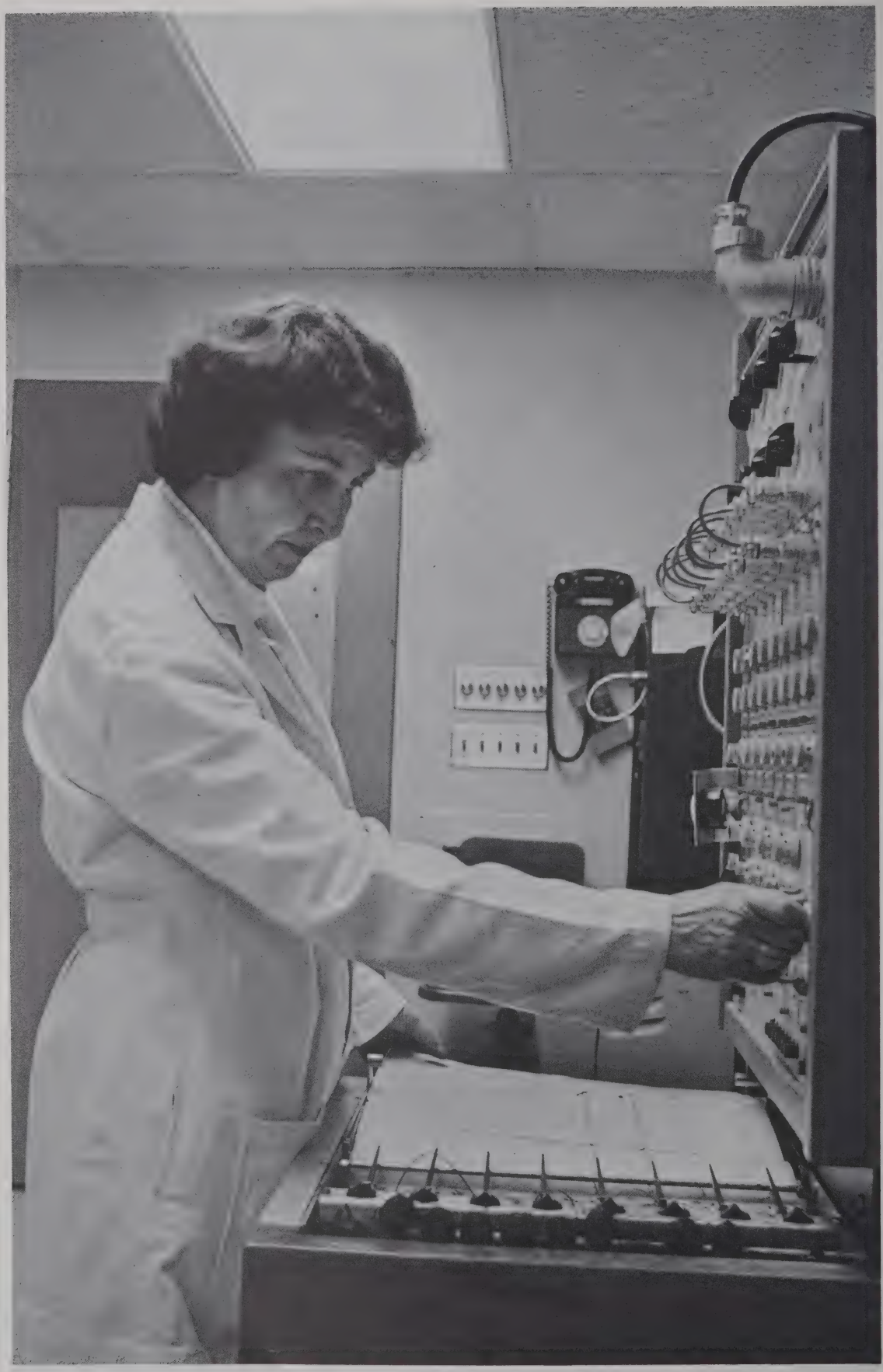
The flow of blood and the resulting oxygenation of tissue is central to the function of all mammalian systems. Here simple questions of surprising importance have not been answered and are being asked in the department. How does the circulatory system protect the animal from the effects of turbulence, with the concomitant energy losses and damage to red blood cells? Is the branching pattern of the circulatory system designed to minimize such turbulence? How well does the circulatory system maintain the oxygen levels required by the brain? What are the effects of circulatory failure on the neural activity of the surrounding tissue?

Physiology is successful if it can describe and analyze such a diversity of systems within a reasonably circumscribed set of procedures. If successful, physiology can tell how tissues and cells perform their biological task and thus it can tell how to repair those tissues and cells if they fail because of disease. To teach the principles of physiological function is our goal in teaching medical, nursing, and graduate students.

Educational Activities

The Department of Physiology is responsible for providing instruction to all university students requiring instruction in physiology to fulfill their degree requirements. In medical physiology, for example, instruction is provided for approximately 150 medical and graduate nursing students, as well as a comparable number of undergraduate nursing students. In addition, in concert with the Graduate Division of Physiology, a variety of courses dealing with the electrical properties of cells and tissues, neurophysiology, active transport, cardiovascular physiology, and applied mathematics is offered to graduate students.





Department of Psychology and Social Sciences

Rosalind D. Cartwright, Ph.D., Chairperson
Frank Leavitt, Ph.D., Director, Section of Psychology
Michael A. Counte, Ph.D., Acting Director, Section of Social Sciences

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Johnson, M.
Johnson, P.
Kolotkin, R.
Leavitt, F.
Linsky, M.
Lofgren, K.
Lopez, M.
McNamara, B.
Martin, D.
Mead, J.
Miller, R.
Moncrieff, E.
Morrell, L. de T.
Nelson, M.
Padonu, G.
Pahel, K.
Pavlou, M.
Pisani, V.
Rebesco, M.
Rogers, R.
Salloway, J.
Schneider, A.
Schoenenberger, J.
Snyder, D.
Stearns, A.
Stephens, A.
Ulrich, L.
Watson, L.
Weber, S.
Wilson, R.
Zeldow, P.

Research Activities

The Department of Psychology and Social Sciences is involved both in basic research with eventual relevance to health care concerns and in research more immediately applicable to the development and evaluation of clinical practice. These studies are being carried out independently and in collaboration with other departments and clinical services.

There is an active area of research in sleep and dream disorders in clinical groups. One ongoing study is attempting to work with the dysfunctional sleep and dream patterns of women following the life crisis of divorce. Other ongoing studies involve the course of cardiac arrythmias in sleep, the test of a mechanical device for the control of obstructive sleep apnea, and the mental content accompanying the narcoleptic attack. Also underway is a study of the sleep disorder accompanying the fibrocitis symptoms.

The department has also sponsored a program of research concerned with neuropsychological changes in aging and senile dementia. The foci of the project are on specific mnemonic and linguistic features of aging and senile dementia and the neuradiologic and electroencephalographic correlates of these features. An out-growth of this project is a current investigation of the temporal gradient of forgetting in postencephalitic patients. A second program of research involves information processing deficits in basal ganglia disorders. We have demonstrated a specific mnemonic retrieval defect in parkinsonism and are now examining the mnemonic effects of chronic anticholinergic therapy in parkinsonism. A recently completed project demonstrated that the Gilles de la Tourette syndrome is not necessarily associated with cognitive dysfunction.

Another study involves the evaluation of the safety and efficacy of a total daily dose of 6.0 mg of Hydergine for the treatment of cognitive, affective, and behavioral symptoms of dementia associated with aging.

A collaborative study is underway on the effects of amino acid supplementation and qualitative manipulation of dietary protein on portal systemic encephalopathy in cooperation with the Section of Hepatology, Department of Medicine.

There are two programs of research concerning persons with chromosome abnormalities. First, what may be the largest and most representative sample of persons with Turner's syndrome has been followed for many years in a behavioral-genetic study of intellectual and personality development. These studies have established the normal verbal intelligence, specific cognitive deficit, absence of severe emotional disorders and social difficulties of affected persons. Currently, the nature of the social difficulties in early adulthood is being studied. Second, interdisciplinary studies of relationships between oxidative processes and intelligence among persons with Down's syndrome (trisomy 21) are being planned in cooperation with the Department of Pharmacology.

A multidisciplinary center for the clinical care and study of persons with Huntington's Disease is being planned in collaboration with the Department of Neurology. The studies to be carried out by behavioral and social scientists include a mapping of the

course of the disease, a study of factors affecting reproductive decisions by persons at risk, and a study of the effects of the disease upon affected families' reliance upon sources of informal and formal support.

A new series of studies of the neuropsychology of emotion are being carried out. These studies are intended to shed light on the behavioral aspects of three conditions: temporal lobe epilepsy, Gilles de la Tourette syndrome, and the post-encephalitic syndromes.

Previous studies of the effects of carotid endarterectomy on cognition and adaptive competence are now being extended to involve persons with transient cerebral ischemic attacks who are not operated on. Two new studies are also beginning, involving the adaptations of geriatric patients with cerebral disease. In one of these, methods for the cognitive retraining of persons with insult to the right cerebral hemisphere are being investigated. In the other, the relation of family structure to the effectiveness of home care of persons with pre-senile or senile dementia is being studied.

Another group of studies is concerned with the investigation and validation of behavioral approaches (biofeedback, counseling, relaxation etc.) to the management of common clinical problems such as headache and other pain, neuro-muscular symptoms, hypertension, voice disorders and obesity. These studies also focus on the identification of selection criteria and patient variables that contribute to treatment outcome.

Studies continue involving the detection of psychological disturbance among patients with low back pain. Clinical tools, particularly useful in the diagnosis of low back pain in patients with negative or questionable findings, are being explored.

A study of alcoholics hospitalized at Sheridan Road Pavilion concerns the behavioral effects of random vs mixed assignment to psychotherapy groups. Systematic comparisons are being made of behavior that is recorded during the treatment program, upon exit and six months after discharge.

Another study, in conjunction with the Multiple Sclerosis Center, examines a variety of issues related to the behavioral adaptation of persons with M.S. Major areas studied are: the bases of different cognitive coping styles, factors influencing the utilization of different types of health care providers, and the relation of life stress exposure to personal attitudes.

A project that has recently been started concerns the behavioral receptivity and adjustment of organizational members to Spectra 3000, a new, automated medical information system being implemented at RPSL. Major emphases on this panel study pertains to the effects of Spectra utilization on various work-related beliefs, attitudes and behaviors.

A study of the nursing aspects of cadaver organ donation has been instituted. This research project utilizes a multi-faceted methodology of observation, survey research, and indepth interviews to determine the nature of the social processes which impinge on cadaver organ donation.

Several studies are underway which involved collaboration with the Department of Neurology. One concerns the evaluation of cognitive correlates of the CT scan changes in cancer patients without cerebral metastases. Another involves the description of the L-Dopa psychosis of Parkinson patients. A third looks at the long term personality, cognitive, sleep and hormonal change in Parkinson patients treated with L-Dopa. There is an ongoing study of the personality factors related to the incidence of cancer.

Research on the psychophysiological organization and behavioral outcome of premature and other high-risk infants is being coordinated by Pediatric Psychology in collaboration with Neonatology and Otolaryngology. Beginning with extensive computer studies of neonatal psychophysiology in the Special Care Nursery, the research incorporates repeated assessments of psychophysiological, behavioral, neurological, and audiological functioning through the first 30 postnatal months. The goal of the research is to identify the earliest signs of mental retardation, learning disability, or other behavioral dysfunction so that infants and young children who need help can receive it as early as possible, while they have their greatest capacity for reorganization, com-

pensation, and adaptive growth.

Another study in Pediatrics employs a social learning paradigm to enhance the coping behavior of children who require repeated blood sampling. Pediatric patients judged appropriate to the study are shown one of four experimental films. Behavioral, psychological, and self-report measures are employed to determine film effectiveness.

The department has its own research laboratories equipped with three-channel tachistoscope, eye-movement camera, flicker fusion apparatus, psychomotor apparatus, high-speed computer facilities, a variety of biofeedback equipment, and polygraphs for the recording of respiration, EMG, EEG and EOG activity during sleep. There is a five-bed unit for the all-night or daytime recording of sleep.

Educational Activities

The department has major responsibility for a curriculum of instruction in behavioral sciences for undergraduate medical education. The curriculum includes fundamental concepts and vocabulary, basic interviewing and relationship skills, human development and behavioral pathology, and a series of special topic seminar courses in areas of interface between behavioral science and medical specialties. The curriculum is intended to prepare the student physician for the psychological, social, and behavioral aspects of patient care.

Internships in Clinical Psychology:

The department offers a one-year internship in clinical psychology, approved by the American Psychological Association, in fulfillment of the internship requirement of university doctoral programs in clinical psychology.

Multiple clinical settings and clinical programs throughout the Medical Center offer training experiences to interns. Programs of special note include the general consultation service, the Sleep Disorder Service and Research Center, the neuropsychology service, the Office of Behavioral Studies, the Multiple Sclerosis Center, the pediatric psychology program, the Children's Therapeutic Day Hospital and School, and the community psychology program. Over 20 professional clinical psychologists staff these programs, which are located throughout the Medical Center. The department is particularly interested in the roles and functions of the professional psychologist in the general medical setting, including his or her contribution to multidisciplinary care of the medical patient.

The internship program is organized along six selective options which match the academic background and career interests of the practicing or research clinician.

The General Clinical Psychology Internship, the broadest option of training, stresses the particularly important clinical and consultative contribution the psychologist can make in the general hospital and the psychiatric setting. Experience is provided with a range of psychiatric and non-psychiatric patient populations. General Psychology interns also participate in the health care program.

The Clinical Child Psychology Internship provides a developmental perspective on psychosocial problems in children and adolescents with emphasis on the role of the family and the community. A variety of diagnostic, consultative, and treatment experiences are provided in both pediatric and child psychiatric settings, including the management of problems resulting from acute and chronic medical conditions.

The Community Psychology Internship is designed to develop new roles for the clinical psychologist in approaching the human problems encompassed by community mental health programs in an inner-city setting. The intern in the program is encouraged to involve himself at all levels of intervention in the community as both a clinical psychologist and a behavior scientist.

The Clinical Neuropsychological Internship emphasizes the psychological study of cognitive and affective sequelae of disorders of the central nervous system, and the psychologist's contribution to the diagnosis and management of neurological disorders. Collaboration and consultation with other disciplines in the neuro-surgical and geriatric

services are an integral part of this elective program.

The Internship in Health Care Psychology emphasizes the application of psychological principles and techniques to complicated medical/behavioral problems. Interns will learn to provide psychological services in the diagnosis, treatment, such as headache, pain, neuromuscular disorders, hypertension states, and multiple sclerosis. Interns in health care psychology will also participate in the general internship program.

The Internship in Sleep Disorders emphasizes the assessment and treatment of dysfunction associated with sleep and wakefulness. Traditional diagnostic and therapy techniques are combined with up-to-date technical skills in a fully equipped laboratory and multi-disciplinary clinical setting. Interns in sleep disorders also participate in the general internship program.

Seven internship appointments are available each year beginning in September. Stipends are provided through Medical Center funds and an NIMH training grant. One internship position is available each year for an exceptional student from a non-APA approved graduate program. Interns are appointed on the Faculty of Rush College of Health Sciences at the rank of Assistant, and as hospital house staff.

Two post-doctoral research fellowships are offered: one in clinical human neuropsychology, the other in sleep and its disorders. These are open to individuals with a doctoral degree in psychology. This program provides advanced training in neuropsychological assessment and human skills, and an opportunity to develop an area of research in one of these two areas.

Application forms and further information concerning the internship or post-doctoral programs can be obtained by writing to Linas A. Bieliauskas, Ph.D., Director of Clinical Training. Deadline for receipt of internship applications is January 15, and procedures for announcement of awards and times for acceptance follow the guidelines of the Association of Psychology Internship Centers. Post-doctoral awards are announced on a yearly basis and may be renewable. Current information concerning these awards is available upon request.

Service Activities

Within the Section of Psychology eight programs of patient care can be described: the Diagnostic and Therapeutic Service, the Neuropsychology Service, the Office of Behavioral Studies, the Pediatric Psychology Program, the Sleep Disorder Service, the Children's Therapeutic Day Hospital and School, the Multiple Sclerosis Center, and the Community Psychology Program.

Diagnostic and Therapeutic Services: The Section of Psychology is particularly active in the development and delivery of health care services in the Medical Center. Consultation on the traditional psychological, psychiatric, and neuropsychological conditions is provided throughout the Medical Center. Specific diagnostic and consultation services are also provided in areas of pain, aging, chronic disease, rehabilitation, psychosomatic problems, sleep difficulties, tension states, cognitive and emotional changes in persons undergoing medical treatments, and problems in patient management. As part of this approach, both traditional and innovative treatment approaches are offered. The department serves as an active referral resource for problems ranging from somatic complaints without physical findings to more acute disturbances seen in relation to medical trauma. Treatment for such persons in addition to traditional ambulatory outpatient care, includes behavioral management, short-term counseling and psychotherapy, and crises intervention, as well as involvement in the family system. This type of consultation and treatment is marked by close interdisciplinary collaboration with physicians and other support services.

Neuropsychology Service: The Neuropsychology Service provides consultation on the psychological sequelae of disorders of the central nervous system and contributes to the management of affected patients. Clinical and research activities are collaborative as well as independent, involving studies of

aging (pre-senile and senile dementias), specific diseases (disease of the basal ganglia, etc.), and other conditions affecting behavior (e.g., stroke, toxic states, epilepsy, psychopathologies).

Office of Behavioral Studies: The Office of Behavioral Studies is an evaluation, treatment, and referral source for complicated medical/psychosomatic problems. Its programs combine newer psychological technologies such as biofeedback and relaxation with traditional psychotherapeutic methods such as behavioral management, brief psychotherapy, and staff consultation and bring these to bear on complex health problems. A wide range of medical conditions is seen that often is not amenable to cure through the application of medical regimens. Such conditions include chronic tension, chronic headache, pain disorders of various etiologies, neuromuscular disorders, hypertension, asthma, GI distress, speech disorders, excessive weight, and post-CVA conditions. Patients with arthritis, lung disease, and other chronic conditions are seen in consultation to help identify and facilitate adaptational changes. The staff maintains close working relationships with other disciplines in the medical setting and patient management is typically in an interdisciplinary program.

Pediatric Psychology: Pediatric psychology is a program of psychological services, consultation, teaching, and research organized within the Department of Pediatrics. The staff of four child psychologists provides diagnosis and therapeutic services to children from birth to 18 years of age and to their families. Patients are both medical inpatients and outpatients who present problems ranging from the more traditional areas of child psychopathology such as difficulties with school or family, to management of problems resulting from acute to chronic illness. Preventive intervention is emphasized and developmental evaluations and other screening procedures are frequent referral requests. Therapeutic strategies are based on conceptualizing problems in individual and interactional terms using a variety of theoretical frameworks. The active focus of therapy includes the entire family, family subgroups, and the individual.

Sleep Disorder Service and Research Center: This service has the capacity to diagnose and treat persons suffering from difficulties of falling asleep, staying asleep, early morning awakening, sleep attacks during waking, and other difficulties associated with sleep such as sleepwalking, nightmares, etc. Patients are monitored throughout the night or during a series of daytime naps in a five-bedroom unit while the EEG of their sleep is recorded. Treatment programs are varied according to the diagnosis; individual psychotherapy, relaxation and biofeedback, and behavioral management are some of the methods available.

Children's Therapeutic Day Hospital and School: This program, staffed largely by child psychologists with joint appointments in the Department of Psychiatry, offers year-round day treatment to children, ages 4 to 13, who have serious difficulties adjusting at school or at home and who therefore do not profit from the usual neighborhood school experience. With an average enrollment of 45 children, the program provides a comprehensive focus on the child through educational, social, psychological, and family services, while maintaining the child in his home and community setting. The primary objective of this program is to provide the necessary educational help and comprehensive therapeutic intervention to reintegrate the child into a regular school setting within a period of two years. Individual and group psychotherapies are provided for children; family therapy is preferred for the families of these children. Psychologists provide program administration and direction, diagnostic assessment, psychotherapy, and consultation, in collaboration with social workers, special educators, occupational therapists,

nurses, psychiatric residents, psychology interns, pediatric residents, and psychiatric consultants. The ongoing program, staff, activities, and physical setting constitute a milieu that provides a model of open, healthy, interpersonal interactions.

Multiple Sclerosis Center: In this comprehensive diagnostic and treatment center for persons with multiple sclerosis, the clinical skills of neurologists and psychologists are combined to provide medical diagnosis and management as well as behavioral and psychological evaluation and intervention. Psychologists provide for individual assessment of each patient's personal and adaptational status and relate this to programs of individual, marital, family, and group counseling. Educational and adjustment programs of the center form the principle mode of behavioral intervention, directed towards the normal individual undergoing unusual long-term stress.

Community Psychology: Psychologists on the staff of the Mile Square Health Center hold faculty appointments in this department. These psychologists are primarily responsible for a program of community mental health services including sustaining care programs, community day treatment programs, outpatient diagnostic and therapeutic services, diagnostic services for developmental disabilities, and work release programs. A multidisciplinary staffing pattern and team approach are seen as essential in providing quality service in diagnosis, treatment, psychosocial, and vocational needs of community patients. Outpatient programs address the needs of children and adults, including a crisis intervention program to provide immediate resources for individuals in crisis. A school psychologist provides special corrective and preventive programs for the early detection and remediation of developmental, educational, and learning disabilities. An art therapy program provides alternate modes of expression for elementary school children in special adjustment classes. A program for the care of young pregnant women who show signs of emotional disturbance has been developed with the Department of Obstetrics and Gynecology. Thus, programs provide direct care and treatment for mentally ill individuals, and also include new multidisciplinary programs targeted to the health care needs of a variety of underserved populations.

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Department of Health Systems Management

Bruce C. Campbell, Dr. P.H., Acting Chairperson

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Taylor, W.
Thompson, L.
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Trufant, J.
Warden, G.
Zieserl, R.
Zimmerman, R.

The Department of Health Systems Management was formally established in 1975. The department's goals are: 1) to provide a graduate program for health systems managers; 2) to provide postgraduate and continuing education for health systems managers; and 3) to develop and apply research to improve the health delivery system.

The faculty consists of practicing professionals at the Medical Center who have management responsibility for administration, management consulting, finance, law, and data processing. Health Systems Management's academic courses and research projects lie within the respective areas of the faculty members' specializations.

Educational Activities
The Graduate Program In Health Systems Management

The Health Systems Management Program at Rush University is a graduate professional program designed to train individuals for careers that will focus on the major problems facing one of the nation's fastest growing industries.

Students are accepted from a wide variety of academic backgrounds. The program provides a strong foundation in health care management and system/industrial engineering through the traditional didactic avenue and through a unique, practical, educational experience at Rush-Presbyterian-St. Luke's Medical Center and its network of affiliated institutions. Students in the program will work with physicians, health scientists, nurses, hospital administrators, health planners, and others concerned with improving quality, controlling costs, and increasing the overall effectiveness and efficiency of the health care delivery system. The program offers students actual management experience in a medical center environment.

Career opportunities for graduates of the health system management program are widely distributed among a variety of health systems and management-related positions. In addition to preparing students for traditional opportunities in hospitals and other health-related institutions, the program will emphasize preparation for administrative positions within:

- multihospital systems on either the corporate or operational level
- consulting firms specializing in health systems
- voluntary agencies and associations in the health field

Professional Goals for Graduates

The program in health systems management undertakes to teach the student to:

- function as a health systems manager with a commitment to the improvement of the health care system
- synthesize principles and concepts of health care delivery, health care management, and systems methodology
- plan, implement, and evaluate health systems
- apply problem-solving principles when making improvements in the health care delivery system
- function independently of and inter-

dependently with other members of the health care team
- relate findings of research to systems management practice
- explore areas for continued research
- analyze the health care system and the manager's role in the context of interacting social, economic, and political systems.
- cope with rapid changes in the patterns of health care to initiate and guide these changes effectively

Curriculum

The program in Health Systems Management is structured around topics in three essential areas: health care services, systems sciences, and applied studies.

1. The area of health care services focuses on various components of the health delivery system, professional participants and their roles, and current health care issues.Students also will review the relevant research and practice of social scientists, legal authorities, economists, and others who have applied their disciplines to problems drawn from the health delivery system.
2. The systems sciences area will develop the student's ability to structure and solve operational and organizational programs in a quantitative manner. Work in this area will teach the student the fundamental skills necessary to analyze and deal with a variety of management issues in the health delivery system.
3. The applied studies area consists of structured systems analysis and management studies formulated to expose the student to a wide variety of systems problems. The student will be required to recognize and define problems and to utilize analytic and managerial skills to reach realistic solutions. When appropriate, the student will fully implement recommendations and evaluate the consequences. Applied studies will utilize Rush-Presbyterian-St. Luke's Medical Center's network of educational and health institutions as a laboratory, and the administrative staffs of these institutions as adjunct faculty.

The curriculum is offered to full-time students only.

Course Requirements

The curriculum is divided into two phases. Phase I, basic studies, consists of two core quarters. Phase II, applied studies, consists of four quarters of courses that provide an intensive, experience-based systems orientation to the hospital and related facilities. The emphasis of Phase II is on review, analysis, and problem solving of actual operational systems. Each student's background will determine the number of quarters to be taken.

I. Phase I—Basic Studies

Consists of two cores: health care services (health core) and systems sciences (systems core) that will provide in-depth orientation. Both cores will be offered during the fall and winter academic quarters. Both quarters will focus on topics of health care services, as well as on certain areas of systems sciences, including quantitative systems analysis, and design methodology.

Students' academic and experiential backgrounds will be evaluated to determine whether they have already acquired the knowledge contained in any or all of these courses. The determination of transfer credit is made by the department chairperson and will be included with the letter of admission. Phase I must be completed prior to entering Phase II. Students entering Phase II directly would need only 58 quarter hours for the M.S. degree.

II. Phase II—Applied Studies

Phase II of the curriculum is composed of four quarters of courses offered in the spring quarter of the first year and in the fall, winter, and spring quarters of the second year. Most of the courses consist of both classroom and practical work in a variety of areas.

After completing the second quarter of Phase II, students are required to select an area of concentration from:

1. Health Law/Public Policy
2. Health Economics and Financial Management
3. Management of Hospitals and Health Care Facilities
4. Industrial Engineering and Operations Research

The concentrated study is equivalent to eleven (11) quarter hours and is taken in the sixth quarter. It could involve one major paper or several significant projects, as well as individual and group seminars. The research methodology course offered in the fourth quarter is intended to help students prepare for the concentrated study.

Health Systems Management Curriculum

First Year Phase I				**First Year Phase II**	
Fall		Winter		Spring	
HSMGT 505	6	HSMGT 503	3	HSMGT 521	4
HSMGT 513	2	HSMGT 514	2	HSMGT 531	4
HSMGT 583	4	HSMGT 533	3	HSMGT 524	4
HSMGT 585	4	HSMGT 584	4	HSMGT 541	2
		HSMGT 586	4		
	16		16		14
Second Year Phase II					
HSMGT 522	4	HSMGT 544	3	HSMGT 562	4
HSMGT 532	4	HSMGT 551	4	HSMGT 599	0-11*
HSMGT 553	2	HSMGT 561	4	Electives	0-11*
HSMGT 542	2	Electives	4		
HSMGT 554	2				
Total	14		15		15
Total					90 quarter hours

*Combination of independent study, and/or electives in the chosen area of concentration will be approved on an individualized basis.

Admissions

Prospective students should have a baccalaureate degree from an accredited college or university. A basic course in financial accounting and statistics is a required minimum. In additional, courses in economics (macro and micro) and computer science are strongly recommended.

A record of academic excellence is an important consideration. Applicants with graduate credit in quantitative or administrative fields who are seeking to complete their master's degree or obtain a second master's degree, are strongly encouraged to apply. Such preparation may reduce the program length. Each application will be evalated on an individual basis by the admissions committee.

Students should submit the following:

1. a completed application form accompanied by the $25 nonrefundable application fee,
2. a copy of official transcripts of all previous college and university studies,
3. three letters of recommendation giving evidence of ability to take part in the program.
4. scores from the Graduate Record Examination or the Graduate Management Aptitude Test.

An interview with members of the faculty is required of all applicants prior to admission.

Research Activities

A major objective of the Department of Health Systems Management focuses on research activities. This research includes studies in the smallest operational components of the Medical Center as well as computerized hospital-wide information systems, the evaluation and proposal of models for health care delivery, and the needs of the population served by the Rush University System and its affiliated and associated institutions. During the past few years specific research has been conducted in the areas of patient services, nursing services, hospital and university support services, management information systems, and financial systems.

Research on patient services has ranged from an evaluation of outpatient programs in practicing clinics and the Emergency Room to the examination of uses of the inpatient facilities at Sheridan Road Pavilion and Johnston R. Bowman Health Center for the Elderly. Both nursing staffing and nursing productivity assessments have been conducted, with special emphasis placed on primary nursing care. Research in hospital and university support services has resulted in a unique system of evaluating housekeeping quality and financial and statistical indices for medical colleges. Project studies in management information systems areas have resulted in improved census systems, better attendance and overtime systems, and an evaluation of the implementation of the Spectra 2000 Medical Information System at Sheridan Road Pavilion. Cost pricing analysis and a systems analysis of the Medical Center budget process have been undertaken in financial system research.

Service Activities

Members of the faculty of the Department of Health Systems Management provide service to the Medical Center through the management positions they hold. Hospital administrators, health care planners, academic managers, financial officers, corporate and labor attorneys, and data processing managers function as both practitioners and teachers. The faculty is supported by managers outside the Medical Center who represent hospital and health care consultants, national associations, and network institutions.

Many of the faculty members also provide service to the improvement of the health delivery system through outside committee work. Members of the faculty have represented the institution as well as the department in activities sponsored by the American Hospital Association, the Hospital Financial Management Association, the American College of Hospital Administrators, the Hospital Management Systems Society, and the Illinois Hospital Association.

Department of Related Health Programs

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Section of Clinical Nutrition

Dorice M. Narins, Ph.D., Director
E. Virginia Pinney, M.S., Associate Director

Faculty

Ayers, W.	Farag, W.	Krueger, C.	Pinney, E.
Carver, L.	Fiedler, N.	Mackey, L.	Roland, D.
Castellanos, M.	Hassel, M.	Mathieson, J.	Weddle, D.
Dolecek, T.	Kolodziej, C.	Narins, D.	

Educational Activities

The Section of Clinical Nutrition is primarily responsible for a program leading to a master's degree in clinical nutrition. In addition, the faculty of the section, by participation in teaching a number of courses outside the department and outside the college, provides medical students, nursing students, and graduate students of other departments with an understanding of nutrition. The section also participates in the education of medical students during clerkships except for practicum. Nutrition courses, either in the regular curriculum or electives, are open to all qualified students.

An integrated internship/master's degree program in Dietetics is planned for 1981. This program will permit students to fulfill the professional experience requirements for membership in the The American Dietetic Association and to take the Registration Examination for Dietitians. Each student will choose either the clinical-community or the food service systems management emphasis for in-depth study at the advanced degree level.

The program integrates course work with practical experience culminating in a final practicum-research component. A brochure providing detailed information about the program will be available upon request after July, 1980.

Research Activities

Faculty of the Section of Clinical Nutrition are increasingly involved both in basic research and in research more immediately applicable to clinical practice. Ongoing projects include development of diets for children with inborn errors of metabolism. These diets are designed to meet the nutritional needs of the growing child within the constraints of the metabolic problems.

In another project, taste acuity of patients with breast cancer is being tested. Changes in food preferences, food patterns and anthropometric measurements also are being monitored in these patients.

A study of the knowledge and attitude of second-year students at five medical schools is underway. Schools include those with formal nutrition classes as well as schools where nutrition is only integrated into other courses. Data from individual schools will be compared and the pooled data will be compared to other studies to evaluate trends in nutrition knowledge of medical students.

In order to determine the understanding women have of the role of nutrition in pregnancy and their knowledge of infant feeding, a survey is in progress in several hospitals. In this study, changes in weight by the mother during pregnancy also will be correlated with the weight and skinfold measurements of her infant.

During the past several years, nutritional assessment has become more widely used to evaluate patients. Some of the techniques presently in use are still in the early stages of development. To improve assessment of nutritional status, certain of the techniques currently in use are being evaluated.

Various aspects of obesity are under investigation from basic studies of the long-term effects of early infant feeding to a study of the effectiveness of various methods of weight control in adolescents. Strain, diet, and early feeding experiences have been shown to alter body composition and adipose tissue metabolism in the rat. These studies are being expanded to explore the effect of pregnancy on fat cell number as well as to continue investigations on early infant feeding.

Service Activities

All members of the section have responsibility for patient care. For some of the faculty, this is a major responsibility; for others, the service is limited to consultation on special cases. As clinical dietitians, members of the faculty are part of the health care team and as such recommend, implement and evaluate individualized nutritional therapies for patients during their hospital stay and during follow-up. Nutrition consultations are provided on request for in-house patients. All faculty are committed to providing nutrition services at Rush-Presbyterian-St. Luke's Medical Center and its network hospitals which incorporate the latest research into clinical practice.

Master of Science Program in Clinical Nutrition

The Clinical Nutrition Program at Rush is a graduate professional program designed to train individuals primarily for careers oriented to patient care and secondarily as preparation for further advanced education. Graduates will be prepared to work with physicians, nurses, and other health professionals in providing total care for the patients in a variety of settings. Career possibilities are varied, including private practice, research, and teaching, as well as the more traditional positions in specialized care facilities, hospitals, departments of public health, and professional organizations. The Clinical Nutrition Program's approach takes students from a wide variety of academic backgrounds and provides a strong foundation in the basic sciences and, through individualized practicum experiences, provides a unique, strong, applied educational experience at Rush-Presbyterian-St. Luke's Medical Center and its network of affiliated institutions.

Philosophy

The program leading to the master of science degree with a major in clinical nutrition is designed to give students a thorough knowledge of clinical nutrition, expertise and confidence in health team interaction, and skills in communication and teaching. Through contact with faculty who are involved to a greater or lesser extent in patient care and preventive nutrition, the student will become familiar with several role models.

Because the vital relationship between nutrition and health is receiving greater recognition, the role of the clinical nutritionist has expanded. New expertise, the ability to assume more significant responsibility as a member of the health care team, and the ability to contribute to the education of practicing and future health professionals is required.

The clinical nutritionist works with physicians, nurses, nurse practitioners, social workers, and other health care providers, all sharing a primary concern—the patient. Effective interaction and communication between these professionals are dependent upon a broad base of common knowledge. Because Rush University has organized its academic programs on the belief that cooperative activities focused on the patient are enhanced by interdisciplinary education, students in the clinical nutrition program take courses with graduate nursing students and with medical students.

Objectives

It is anticipated that, upon completion of the master of science program in clinical nutrition, the graduate will be able to:

- obtain nutritional history information and correlate it with physical, anthropometric, clinical, and biochemical data to evaluate the dietary and nutritional status of the patient in the hospital or in an outpatient clinic;
- advise and recommend to the physician or primary health care provider a feasible nutritional management program for the patient, implement the nutritional care plan, evaluate and adjust where necessary;
- function as a consultant to the entire health care team—physicians, nurses, physical therapists, social workers, and health students—regarding the nutritional care of the patient;
- function as a nutrition educator and coordinator of education in nutrition for practicing health professionals, as well as students of health professions;
- function as an effective educator in nutrition for patients, their families, and community members;
- function as a resource for nutrition information and guidance needed by the health care team, in the hospital, and in the community; and
- actively educate the public regarding preventive nutrition practices.

Prerequisites

Applicants to the graduate program in clinical nutrition should have completed a baccalaureate degree from an accredited college in one of the fields of foods and nutrition, dietetics, biochemistry, biology, or nursing. Specific course offerings and requirements may vary from campus to campus due to differences in curricular design, scheduling, and course content. Because baccalaureate programs vary somewhat, each will be reviewed to ensure the student has the background necessary for the master's program. The following listing suggests the kinds of courses which are normally required before the student comes to the Rush campus:

Courses*	Quarter Hours	Semester Hours
Chemistry, inorganic, organic, and biochemistry	16-18	12
Human Physiology	10-12	6-8
Nutrition (must include Nutrition in Disease and/or Diet Therapy)	15-18	12
Behavioral & Social Sciences	21-24	16
Communication Sciences (must include Statistics)	10-12	6-8
Total	71-84	51-55

*Before taking the ADA registration exam, the student must also complete the minimum academic requirements for ADA membership.

Eligibility

All factors are taken into consideration when evaluating each student's application. Students are not necessarily excluded or accepted into the program because of deficiencies or proficiencies in any one area. An applicant not meeting regular admissions requirements may, at the discretion of the Graduate Admissions Committee, be offered enrollment as a special student as defined below.

The graduate program recognizes three categories of students:

1. Regular students, who have been accepted for admission to the master's degree program;
2. Special students, who have not been accepted to the degree program but have permission to enroll in specific courses for academic credit (there is a limit of three courses or eight quarter hours in this category);
3. Auditors, who have obtained permission to attend a course but are not seeking academic credit (no academic grade is reported).

Method of Application

An application and recommendation forms for the clinical nutrition program may be obtained by writing:

Director of Clinical Nutrition
College of Health Sciences
Rush University
1743 West Harrison
Chicago, Illinois 60612
(312) 942-6861

Applicants to the graduate programs in clinical nutrition should make certain that the following material is on file at the College of Health Sciences at least two months prior to the beginning of the term of expected matriculation:

1. completed application;
2. $25 application fee;
3. three letters of recommendation;
4. results of the Graduate Record Examination (G.R.E.)

Curriculum

Fall		Winter		Spring		Summer	
BIOCH 461	3	BIOCH 462	3	BIOCH 463	3	NUTRI 513	4
NUTRI 524	4	NUTRI 566	1	NUTRI 567	1	NUTRI 591 or	
NUTRI 565	1	HLCED 584	2	PPHYS 576	2	NUTRI 599	4
PHYSO 511	4	PHYSO 512	5	NUTRI 561	1*	NUTRI 561	2*
HLCED 583	2	NUTRI 511	1	NUTRI 512	3	NUTRI 531	1
		NUTRI 561	1	NUTRI 501	2		
	14		13		12		11
Total required courses							50
Electives							6
Minimum for graduation							56

*Student needs only 4 hours of NUTRI 561, total number per term may be different from that shown. Electives must include at least two credits in HCSYS, HLCED, HLSOC, or HSMGT. Courses may not always be offered in the sequence listed.

Tropicana

Section of Medical Technology

Marjorie Stumpe, M.A., Director
Herb Miller, M.H.S., Assistant Program Director
John P. Ayer, M.D., Medical Director

Faculty

Gewurz, A.
Kachmar, J.
Kaplan, R.
Miller, H.
Siegel, J.
Stumpe, M.

Teaching Assistants:
Bishop, C.
Kwiatkowski, J.
Gvazdinskas, L.
Nichols, V.
Rojek, K.

Educational Activities

The Bachelor of Science Degree Program in Medical Technology requires successful completion of the pre-health curriculum and the upper division study at Rush University. A student enrolled at an affiliated college for the Rush program will file appropriate forms with the College of Health Sciences to formalize participation in the program. The students' academic program will be monitored by both Rush and the health careers advisor of the affiliated college. Admission into the program is competitive and only the most qualified applicants will be accepted. All candidates for admission must provide evidence of good physical and mental health. Students meeting the objectives of the pre-health curriculum and obtaining the approval of the affiliated college health careers advisor will be considered for admission into the program.

Transfer Applicants. The College of Health Sciences also considers a limited number of transfer applicants who have satisfactorily completed the pre-health curriculum at an accredited college or university. Rush University does not offer the pre-health curriculum on its campus. No transfer credit is awarded for required course work in which the student earned less than a "C" grade or its equivalent. Required courses should be taken for a grade rather than a pass-fail option. Selection is competitive, and only the most qualified applicants will be accepted.

Transfer applicants apply directly to the College of Health Sciences. It is advisable to apply early in the academic year preceding the intended year of matriculation. Guidance in course selection is available through the Admissions Office at Rush.

Applications for transfer students may be obtained from:

Director, Medical Technology Program
College of Health Sciences
Rush University
1743 West Harrison Street
Chicago, Illinois 60612
(312) 942-6987

The application should be accompanied by a $25 non-refundable application fee, high school transcript (including test scores), all college and university transcripts, and three recommendations. A personal interview is also required as part of the application process.

Applicants whose first language is not English, must take the Test of English as a Foreign Language (TOEFL), administered by the Educational Testing Service in some 95 foreign centers. Applications for the TOEFL Examination may be obtained from the Educational Testing Service, Box 995, Princeton, New Jersey 08540.

When the application is complete, all items are reviewed and evaluated. If required course work is still in progress, an offer of acceptance is contingent upon satisfactory completion.

Philosophy

The contribution of medical technology to the patient and to the health care delivery system is primarily one of diagnostic services. As clinical medicine expands in the variety and number of diagnostic tests performed, and as new methodologies and instruments become increasingly sophisticated, there is a crucial need for more high-quality professionals—not merely more technologists. Today's professional technologists must not only develop technical expertise, but teaching and administrative competence as well. They must be able to adapt to rapid changes in the field while maintaining an optimal level of performance. As members of the health care team, medical technologists must have a basic understanding of the role of other health practitioners in order to function effectively and bring the best possible care to the individual and the community. Although the work in medical technology often does not place the practitioner in actual physical proximity to the patient, the technologist, nevertheless, must maintain a high degree of compassion and empathy and a constant awareness that the welfare of the patient is the ultimate goal.

It is the aim of the Rush University baccalaureate program in medical technology to educate technologists to meet the changing needs of laboratory medicine more effectively and with greater efficiency.

Objectives

The objectives of the program in medical technology are to provide educational experiences which will enable the student to:

- acquire knowledge and proficiency in the technical skills required in the medical technology profession;
- develop problem-solving abilities in the application of scientific theory to the clinical practice of medical technology;
- acquire the basic principles of management to assist in the supervision of medical technologists and other supportive level laboratory personnel;
- appreciate the importance of continuing education as an avenue of professional growth;
- acquire an understanding of the roles of other members of the health care team and an ability to function cooperatively within the team;
- appreciate and practice professional ethics in providing quality health care to the patient and to the community.

Pre-Health Curriculum

The pre-health portion of the medical technology program is taken at an affiliated college and requires two or three years of study, depending upon the college. These years are devoted to preparing the scientific foundation upon which the practice of medical technology can be built. The first year emphasizes courses in biological, physical, and behavioral sciences, with options in the humanities. The succeeding pre-health years

are used to increase depth in the sciences as they relate more specifically to health fields and to enhance personal experience by a broad choice of electives in the humanities.

Each affiliated college has a unique participation with Rush. Specific course offerings and requirements may vary from campus to campus due to curriculum offerings, scheduling, and course content. Each pre-health curriculum is different, but all provide the background necessary for the professional component of the program in the final two years. The following listing suggests the kinds of courses that normally are required before a student comes to the Rush campus.

Pre-Health Curriculum

Courses	Quarter Hours	Semester Hours
Chemistry, Inorganic	10-12	8
Quantitative Analysis	5-6	4
Chemistry, Organic	5-6	4
Human Anatomy and Physiology	10-12	8
Microbiology	5-6	4
Statistics, Introductory	4	3
Behavioral Sciences (Psychology, Sociology, or Anthropology)	18	12
Academic Electives	33-26	17
Total	90	60

Upper Division Studies

Following the pre-health curriculum, upper division studies are devoted to completing the professional segment of the program leading to the bachelor of science degree with a major in medical technology.

The comprehensive technical curriculum at Rush University prepares the student to enter the practice of medical technology. Each graduate is eligible to take the National Certifying Examination given by the American Society of Clinical Pathologists, and upon passing the examination becomes certified as a Medical Technologist, MT(ASCP). Graduates are eligible to take any of the other national certifying examinations if they so desire. The program is accredited by the American Medical Association's Committee on Allied Health Education and Accreditation (CAHEA).

In the junior and senior years the student integrates the theory of clinical medicine with the practice of clinical laboratory procedures, learning basic theory and skills in hematology, clinical chemistry, immunology, and clinical microbiology in the junior year; going on to more advanced courses in those areas in the senior year. Senior students apply basic concepts as they rotate through the laboratories of Presbyterian-St. Luke's Hospital and other affiliated institutions. In addition, students are prepared to fill supervisory and teaching positions through courses in management.

Baccalaureate Medical Technology Curriculum

Third Year

Fall		Winter		Spring	
MEDTK 301	4	IMMUN 301	3	BIOCH 402	5
MEDTK 303	4	MICRO 311	5	MICRO 411	5
BIOCH 301	4	BIOCH 401	3	IMMUN 403	3
MEDTK 302	1	HEM 301	5	IMMUN 421	3
	13		16		16

Comprehensive Examination

A comprehensive examination will be given at the end of the third year of study. Students must pass this examination in order to continue into the fourth year of the program.

Fourth Year

Fall		Winter		Spring	
HEM 425	2	HEM 426	2	MEDTK 424	8
IMMUN 402	2	MEDTK 422	8	MEDTK 441	2
MEDTK 421	8	BIOCH 403	2	HSMGT 301	3
MEDTK 423	4	MEDTK 425	4	BIOSCH 404	2
	16		16		15
Subtotal					92
Pre-Health Curriculum					90
Total					182

*Courses may not be always offered in sequence listed.
*All courses are required courses.

Service Activities

Most of our faculty members are actively involved in the clinical laboratories of Rush-Presbyterian-St.Luke's Medical Center, maintaining active research or clinical positions in their areas of specialty. Several of our faculty hold joint appointments in Rush Medical College. Our program faculty and resources span the gamut of clinical laboratory medicine and, therefore, we actively support and participate in all areas where technical laboratory application is involved.

Section of Speech and Hearing Sciences

David L. Ratusnik, Ph.D., Director

Faculty

Bacon, M.	Klodd, D.	Ratusnik, D.	Schewitz, S.
Harsch, G.	Ostreicher, H.	Robinson, J.	Wolfe, V.

Educational Activities

The Section of Speech and Hearing Sciences provides professional training in speech-language pathology and audiology. The section offers a six-quarter program leading to the Master of Science degree in (1) speech-language pathology or (2) audiology. The course of study also provides the basis for certification by the American Speech-Language-Hearing Association (ASHA). The program is one of the few in the United States which bases its education of speech pathologists and audiologists on the facilities and opportunities offered by an academic medical center. In addition to teaching and supervisory responsibilities for the Master of Science degree programs in the College of Health Sciences, faculty members cross college lines, involving themselves in articulating the practical and service-related aspects of communicative disorders through resident, clerkship, and in-service programs in Presbyterian-St. Luke's Hospital.

Philosophy

The basic tenet of the faculty in the Section of Speech and Hearing Sciences is that the professional education of speech pathologists and audiologists, who look to practice in hospitals or other health care facilities, is optimized by drawing upon patients, staff and the physical resources of an academic medical center. In contrast to many professional training programs, the clinical skills of Rush students are fostered, grow and mature via observation and supervision by faculty-clinical practitioners. All faculty are ASHA certified and participate fully in the clinical process, serving patients presenting a full range of communicative disorders. In addition to close clinical supervision which provides the necessary foundation for clinical education, the faculty has developed a curriculum intended to meet ASHA standards. This is supplemented by the expertise of physicians, scientists, and other health care personnel within the Medical Center. Additionally, the faculty's commitment to research and the belief that an appreciation of scientific matters is valuable to the clinical process and professional growth, provide the basis for masters thesis research in the program.

Research Activities

Members of the Section are actively involved in basic and applied research concerning hearing, speech, voice and language with numerous clinical populations. Publication and presentation at major national and international conferences are fostered. Studies are conducted both independently and in collaboration with faculty from departments and services within the hospital and the colleges of the Medical Center.

Service Activities

Speech pathologists and audiologists in the Section of Speech and Hearing Sciences provide a full range of diagnostic and therapeutic services for the communicatively impaired through the Section of Communicative Disorders, Department of Otolaryngology and Bronchoesophagology. Staff members have demonstrated considerable expertise in developing specialized evaluative and treatment programs for the communicatively handicapped.

In conjunction with the Head and Neck Cancer Program, techniques have been developed for improvement of speech, voice and swallowing. New procedures for auditory evoked potential testing and electrocochleography have been valuable in the assessment of hard-to-test individuals, in ruling out acoustic neuromas, and in the detection of brainstem lesions. Electromyographic biofeedback has been applied with hyperfunctional voice and stuttering impair-

ments. Other service programs include electronstagmography, spectrographic voice evaluations, comprehensive management of right CVA patients, neonatal hearing testing, and videofluoroscopic evaluation of speech, swallowing and resonance problems. Patient referrals are made from a broad base of health care providers.

Prerequisites

Applicants to the graduate program should have completed a baccalaureate degree from an accredited institution in either communicative disorders, speech pathology, audiology or special education. Transcripts should reflect a strong record in the following coursework: Introduction to Psychology, Child Psychology, Statistics, Phonetics, Language Acquisition or Linguistics, Acoustics or the Science of Sound, Anatomy and Physiology of the Speech and Hearing Mechanism. Applicants should have participated in the management of cases presenting a range of communicative disorders for 50-100 contact hours. Students considering public school placements should complete coursework and practicum to this end at their undergraduate institutions.

The process of gaining authorization from the State of Illinois Board of Higher Education to offer degrees in this program has been initiated.

Curriculum: Major in Speech-Language Pathology

Fall		Winter		Spring		Summer		Fall		Winter	
SHS 501	3	SHS 503	3	SHS 513	3	SHS 514	3	SHS 590	10	SHS 590	10
SHS 505	3	SHS 512	3	SHS 524	3	SHS 562	3	SHS 598	3	SHS 598	3
SHS 511	3	SHS 522	3	SHS 564	3	SHS 581	3	SHS 599	3	SHS 599	3
SHS 521	3	SHS 531	3	SHS 565	3	SHS 599	3				
SHS 551	3	SHS 563	3	SHS 599	3						
SHS 561	2										
Total hrs	17		15		15		12		16		16

Curriculum: Major in Audiology

Fall		Winter		Spring		Summer		Fall		Winter	
SHS 501	3	SHS 503	3	SHS 518	3	SHS 519	3	SHS 595	10	SHS 595	10
SHS 505	3	SHS 506	3	SHS 526	3	SHS 527	3	SHS 598	3	SHS 598	3
SHS 516	3	SHS 517	3	SHS 533	3	SHS 544	3	SHS 599	3	SHS 599	3
SHS 541	4	SHS 522	3	SHS 542	3	SHS 581	3				
		SHS 531	3	SHS 543	3	SHS 599	3				
Total hrs	13		15		15		15		16		16

Method of Application

Applications and recommendation forms may be obtained by writing:

David L. Ratusnik, Ph.D.
Director, Section of Speech and Hearing Sciences
College of Health Sciences
Rush University
1743 West Harrison Street
Chicago, Illinois 60612

Department of Religion and Health

Christian A. Hovde, Ph.D., D.D., The Bishop Anderson Chairperson
Bernard Pennington, M. Div., Director, Clinical Pastoral Services

Faculty

Burck, R.	Fitchett, G.	Pennington, R.	Wagner, W.
Corrigan, J.	Hovde, C.	Ulrich, L.	

Research Activities

Until recently, the department had been functioning as a service and training department and had not been actively engaged in research. Research is now being incorporated into the training of clinical pastoral education (CPE) theological students. Areas now being investigated include: attitudinal changes to life crises following educational process; faith systems and their effect on mobilization of physical resources; religious symbolism and patient/family support systems; and acute grief behavior.

Educational Activities

The department provides an accredited program in clinical pastoral education for pastoral personnel, in humanistic and theological studies within the colleges, and in research in the area of religion and health.

Accredited by the Association for Clinical Pastoral Education, the department offers basic, advanced, and supervisory education in pastoral care. This program is oriented to graduate theological students, pastors, members of religious orders, or other health personnel who are interested and involved in pastoral care and counseling in the midst of a health crisis. Under faculty supervision, students carry direct responsibilities for ministry within patient care areas on an ecumenical basis which includes a sensitivity to particular parochial practices. Students use clinical pastoral education in preparation for parish ministry, chaplaincy, teaching, pastoral counseling, or CPE supervision.

Basic Clinical Pastoral Education. An intensive 11-week introduction to pastoral care, basic CPE focuses on models of ministry and their effect in patient care. Viewing the patient as a partner in learning, students engage in theological reflection and use pastoral resources with patients and health personnel; they work toward better understanding of the interface between theology and behavioral sciences in understanding the human condition. Students may be accepted for this course from any discipline or field of study. The course descriptions found elsewhere in this catalogue are built on the experience of teaching the materials for theological students. However, there is no inherent difficulty in incorporating non-theological students into the course.

Advanced Clinical Pastoral Education. Advanced CPE is a year-long residency program for persons who have already completed their basic theological degree, have had pastoral experience, and want a pastoral care specialization, such as certification as a chaplain through the College of Chaplains, American Protestant Hospital Association. Students function as pastoral members of interdisciplinary health teams to develop the capacity to utilize their pastoral perspectives and competence through a variety of pastoral encounters.

Supervisory Clinical Pastoral Education. Supervisory CPE is designed for qualified persons who have demonstrated pastoral professional competence, and who want to specialize in supervision in preparation for certification with the Association for Clinical Pastoral Education. Students are helped to develop both a theory and theology of pastoral practice, a philosophy of CPE that includes understanding appropriate educational models' theory and practice, and a versatility in using supervisory skills and methods.

The program of religion and health is currently being developed to enlarge upon existing course offerings for interdisciplinary and clinical experiences within the various colleges of the university. The Bishop Anderson Professorship has been established for teaching in religion and health. The primary concentration of teaching in this program has been in thanatology, ethics, and in the philosophy of medicine.

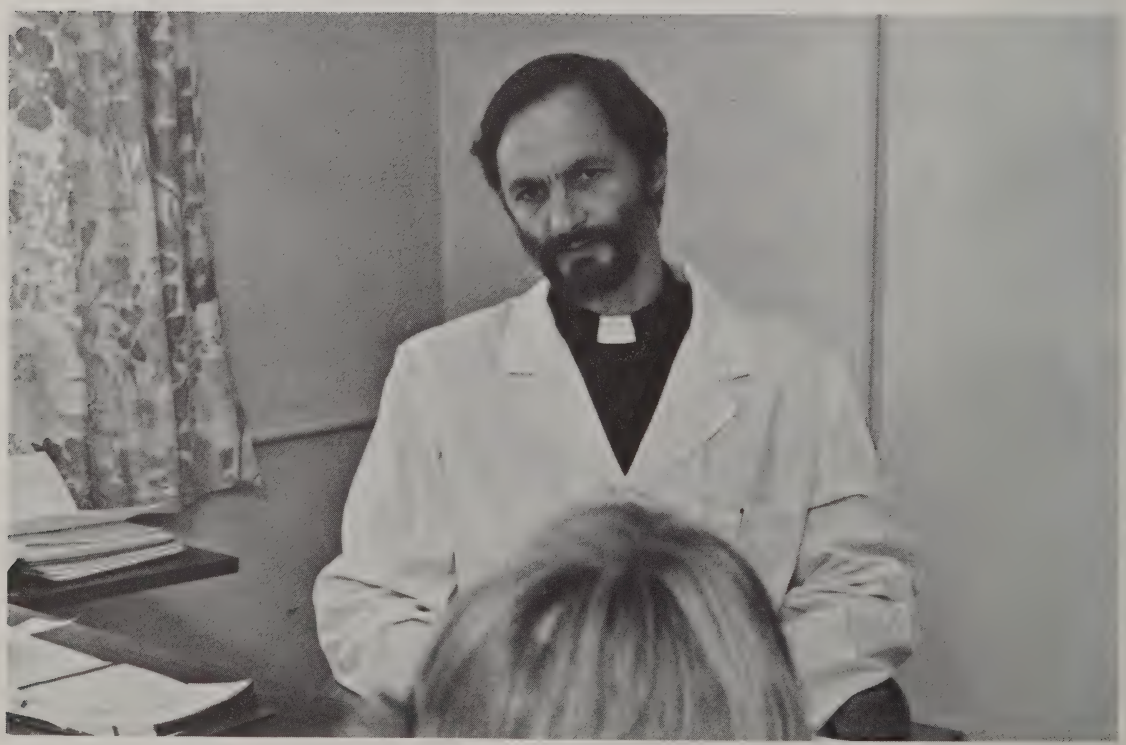
Service Activities

The Department of Religion and Health is responsible for providing pastoral care to patients, their families or supporting persons, and the staff personnel who serve them within Rush-Presbyterian-St. Luke's Medical Center. The department provides round-the-clock religious ministry to patients in the hospital, providing sacraments, church services, individual counseling, and grief ministry to any person who is in need of them. It is available to support members of the student body and staff and to respond to emergencies when needed.

Courses Offered

(For complete course descriptions see section on course offerings, page 164.)

RELH 453 Illness and Faith
RELH 501 The Art of Healing
RELH 611 Clinical Case Conference
RELH 615 Sermon Preparation and Delivery
RELH 621 Personal and Professional Concerns
RELH 623 Didactic Presentations
RELH 650 Individual Supervision
RELH 681 Guided Study or Research
RELH 685 Clinical Practice
RELH 689 Comprehensive Evaluations



Credit

Credit Hours. The quarter hour is the unit used by the College of Health Sciences for determining credit for courses taken at Rush University. One quarter hour generally represents a lecture or seminar meeting one hour each week, or a laboratory or clinical experience of two or three hours per week (sometimes more) for the ten weeks of the quarter. An examination for each course generally is given during the 11th week.

Full-time students will carry a course load of 12 to 17 hours each quarter.

Outstanding students may petition the dean to register for additional courses. Written approval is required. Degree candidates must also obtain permission for less than full-time course work.

Part-Time Study

Undergraduate students must plan on full-time course work.

Graduate students may enroll for courses on a part-time basis. However, all prerequisites for a specific course must be met before admission to the course. Part-time graduate students must complete degree requirements within 36 months. The program director has the discretion to make special arrangements in the above cases.

Graduate students enrolling on a part-time basis may be able to switch to full-time enrollment depending upon availability of courses and approval of their program director.

Absences

Students are fully responsible for all material presented in class sessions. Students are expected to attend all seminar and clinical practice periods, and are fully responsible for all content presented therein. When illness or other special circumstances prevent attendance, the student must inform the instructor in advance, when possible, in order to plan for meeting objectives on an individual basis. Students absent from a final examination will receive a zero for that examination or an incomplete for the course as determined by the course director.

Examinations

The examination policy is the responsibility of the individual course director, who will inform students of examination requirements for that particular course. A period at the end of the quarter is provided for final examinations. This period may be used as the course director chooses.

Transfer of Credit

Undergraduate courses taken at an accredited college or university that fulfill the pre-health curriculum requirements may be applied toward the baccalaureate degree in medical technology at Rush. Elective credit may be fulfilled by upper division courses taken at another institution.

Graduate level courses taken at a recognized college or university may be applied to the master of science degree at Rush, subject to the approval of the program director. Credit in excess of nine quarter hours requires approval of the dean.

Concurrent enrollment at another institution must be approved by the dean. A Transfer Credit Approval form, available in the Office of the Registrar, must be submitted to the dean within 30 days prior to commencement of the concurrent study.

Registration

Registration for a new term is normally completed in an announced pre-registration period during the preceding term. Students must be registered and in attendance no later

than Monday of the second week of each quarter or they will be dropped from the class roster. Registration, dropping and adding courses, and withdrawal from school must be done by completing forms provided by the Office of the Registrar.

Registration is complete only after tuition and fees have been paid in full or deferred payment contracts have been signed with the Office of Financial Affairs. Students may attend classes only after they have completed registration. Students registered in a course but failing to participate will receive "F" grades.

Identification Cards. Each student receives an identification card at matriculation. Each term the card is validated at the completion of registration. A valid card is needed for identification within the Medical Center complex, for use of the library, and for admission to some events.

Independent Study. With written permission from the program director, a student may pursue an independent reading or independent clinical study. A preceptor works with the student in designing, monitoring, and assessing the course work. A student interested in this option must fill out an Independent Study Contract six weeks before the quarter the course is taken. Contracts are available in the Office of the Registrar.

Adding or Dropping a Course

After the registration form has been accepted by the Office of the Registrar, students may add or drop courses by completing a form provided by that office. The student's advisor must sign these forms before they will be accepted. Monday of the second week of the quarter is the last day to add a the official date of withdrawal from a course is determined by the date the completed form is returned to the Office of the Registrar. If a student withdraws by the end of the first week of classes, the course will not appear on the academic record. A "W" grade will appear on the record if the withdrawal occurs between the beginning of second week and midterm. After midterm a "WP" or "WF" grade will be recorded depending on whether the course director considered the student to be doing passing or failing work at the time of withdrawal.

Leave of Absence

A health science student who must interrupt his or her studies for reasons such as sustained ill health or compelling personal situations may apply for a leave of absence for a stated period of time, usually not to exceed one year. Leave of absence requests must be submitted in writing to the Student Evaluation and Promotion Committee and the program director. If approved by them and by the dean, the student must satisfy the conditions of the leave before reentering and must comply with all policies, requirements, and course sequence in effect at the time of reentry. The student will pay tuition and fees at the rates in effect at the time of reenrollment.

Withdrawal from School

Students planning to withdraw from school voluntarily must complete a form available in the Office of the Registrar. The student will obtain appropriate signatures while returning all Medical Center materials, the identification card, and name pin. Withdrawal is final once all Medical Center bills have been paid and the completed form submitted to the Office of the Registrar.

Grades

Transcripts and Grade Reports. Grades are recorded on the student's permanent academic record in the Office of the Registrar. A transcript of the academic record is official with the signature of the registrar and the corporate seal of Rush-Presbyterian-St. Luke's Medical Center.

Official transcripts are released only by written request. Forms for this purpose are available in the Office of the Registrar for on-campus students. There is no fee for this service.

Transcripts will not be released until the student has paid all bills due the Medical Center.

Quarterly grade report forms are sent to the student's local address as soon as grades are recorded each term. This is a student copy only and it should not be accepted by any institution or agency in lieu of an official transcript.

Grade Point Average. Each student maintains a grade point average for all work completed at Rush using the grading system described below. The grade point average is determined by dividing the number of points received by the number of credit hours attempted in which A, B, C, D, or F grades were received. This computed grade point average is not affected by courses taken on P/N basis or by courses transferred from another institution. These courses are added to the credit hour total only.

Grading System. The following grades are used to report the quality of work at Rush:

Grade	Quality	Grade Points
A	Excellent	4
B	Good	3
C	Satisfactory for undergraduate but below the level expected of a graduate student	2
D	Minimal passing	1
F	Failure	0
P	Passing	—
N	Not passing	—
I	Incomplete work	—
W	Withdrawal prior to midterm of the quarter	—
WP	Withdrawal after midterm—quality of work was passing at the time of withdrawal	—
WF	Withdrawal after midterm—quality of work was failing at the time of withdrawal	—

Undergraduate Student Grades. A grade of "P" or "N" is given for elective courses at the discretion of the instructor and in some cases when the student petitions, not later than the first week, to take the course on a P/N basis with the instructor's permission.

The grade of "I" is normally given only when circumstances beyond the control of the student prevent completion of course requirements. Students receiving a grade of "I" are responsible for finding out from the instructor the exact work required to remove the incomplete. In the case of a required course, work shall ordinarily be completed and a letter grade received by the end of the fifth week of the next quarter the student is enrolled or sooner at the discretion of the instructor and course director. An "I" grade not removed by midterm will revert to a final grade as determined by the course director. A grade of incomplete in an elective course will automatically revert to a failing grade unless a change of grade is received by the registrar within one calendar year.

Undergraduate students may repeat a practicum course in which they received a grade of F. The new grade replaces the F in the cumulative grade point average. Such a repetition may be done only once.

Dean's List. Undergraduate students earning a 3.5 or higher grade point average for at least 12 credits for a quarter are given recognition by having their names placed on the dean's list.

Graduate Student Grades. Graduate students must earn a 3.0 cumulative grade point average to graduate and may repeat a course in which a C, D, or F has been assigned. These courses may be repeated only once but the grade for the repeated course replaces the first grade in the cumulative grade point average.

Graduate students may request an incomplete from the course director. An I grade not removed by the end of the next quarter will revert to a final grade as determined by the course director.

Elective courses taken in other colleges of the university may be taken for a pass or fail grade. If a student wishes to obtain a letter grade for one of these courses the student must negotiate with the instructor within the first week of the course.

Academic Progression

The faculty reserves the right to request the withdrawal of any student whose conduct, health, or performance demonstrates lack of fitness for continuance in a health profession. Any such student not voluntarily withdrawing will be dismissed from the university.

Undergraduate Progression. High academic performance in required courses is expected. Undergraduate students will be considered in good standing at Rush University unless placed on academic probation.

Academic Probation is assigned to any student who receives a quarterly grade point average below 2.0 or whose cumulative grade point average falls below 2.0. Students placed on probation have two quarters in which to regain the status of good standing. Failure to do so will result in dismissal from the university. Medical technology students may receive no more than one D in the following courses each year to remain in the program:

BIOCH 401, 402, 403, 404
IMMUN 301, 402, 403, 421
MICRO 311, 411
HEM 301, 425, 426
MEDTK 301, 303

An F grade in any of these courses will result in dismissal.

Comprehensive Examination. Each student in the medical technology program must pass a *Departmental Comprehensive Examination* which is given following the third year of study. This examination covers all material presented in the third year curriculum. Students failing this examination will not be allowed to continue to the fourth year of the program when the practicum courses are offered. A failing mark on the *Departmental Comprehensive Examination* given at the end of the third year of the program results in dismissal from the program regardless of previous grades earned.

In the fourth year of the program, work in practicum courses must be at the "C" level or better. Any work in practicum courses below the level required for a C grade will result in an F grade. An F grade in such may be repeated only once with the new grade replacing the F in the cumulative grade point average. A second grade of F in a practicum course will result in dismissal.

Graduate Progression. Only grades of A, B, or C may fulfill degree requirements in all required courses as listed in curriculum outline. A clinical nutrition student who earns a C grade in NUTRI 511, 512, or 513 must make special arrangements with the program director to repeat that work. Less than a C grade in those courses will result in dismissal from the program.

Students must earn a cumulative grade point average of 3.0 in order to graduate. A student whose cumulative grade point average falls below a 3.0 may enroll for one quarter as a probationary student to attempt to raise his or her cumulative grade point average. Further enrollment will be denied if the grade point average is not raised to a 3.00 in that quarter.

Reenrollment

Any student who has withdrawn from a program or has not been enrolled for two consecutive quarters or any dismissed student may apply for readmission by submitting an application for this purpose with a fee of $25.00 to the Office of Admissions. Applications for reenrollment must be received at least one quarter before the planned return. Reentering students must meet the conditions for reenrollment stated in their dismissal or reentry acceptance letter, and all policies, requirements, and course sequence in effect at the time of reentry. The student will pay tuition and fees at the rates in effect at the time of the reenrollment.

Requirements for Graduation

Bachelor of Science. The bachelor of science degree, with a major in medical technology, requires a minimum of 180 quarter hours. This includes at least 90 quarter hours earned as a lower division student at an affiliated school or before entrance as a transfer student.

Candidates for the bachelor of science

degree must earn a 2.0 cumulative grade point average in all computed upper division credits taken at Rush University.

Participation in cap and gown at commencement exercises is expected of all graduates.

After receiving the baccalaureate degree, graduates are eligible to take the National Certifying Examination given by the Board of Registry of the American Society of Clinical Pathologists, as well as other national certifying agencies.

Graduation Honors. Candidates for the bachelor of science degree who have demonstrated academic excellence are honored at commencement exercises by the Rush University faculty each spring. Those earning a 3.4 or better grade point average based on six quarters at Rush are awarded the bachelor of science *cum laude*; those with 3.6 or better, *magna cum laude*; those with 3.8 or better, *summa cum laude*. This is based on six quarters of work at Rush and does not include any work done at other institutions.

Master of Science. The master of science degree requires a minimum of 54 quarter hours. A cumulative grade point average of 3.0 is required. All requirements for the degree must be completed within 36 months.

Candidates for the master of science degree are urged to participate in the commencement exercises in June, though many will complete degree requirements during the following August.

Student Records

The Family Educational Rights and Privacy Act of 1974 protects the privacy of current and former students enrolled in most educational institutions.

Rush University has five official student records for health science students. A student or former student may inspect and review these records after making an appointment with the appropriate office. The records and their locations are as follows:

1. Official academic record (transcript)—Office of the Registrar, 1 Schweppe-Sprague.
2. Registrar's folder—Contains admission application, transcripts from other schools, registration information—Office of Registrar, 1 Schweppe-Sprague.
3. Dean's folder—Contains written evaluation of clinical work, curricular flow charts, grade report copies—offices of the program directors, clinical nutrition and medical technology, 4 Schweppe-Sprague—religion and health, 7 Schweppe-Sprague—health systems management and the Graduate School, Office of the Dean, 4 Academic Facility.
4. Financial affairs folder—Records showing all billing and payments, notes and correspondence dealing with a student's finance—Office of Student Financial Affairs, 1 Schweppe-Sprague.
5. Financial aid folder—All information concerning financial aid for the student—Office of Financial Aid, 1 Schweppe-Sprague.

Students may obtain copies of transcripts from the institutions that hold the original records. Other portions of their records will be copied upon request. The request must be in writing, signed, and specifically identify the record desired and include the student's major, year, date of birth and social security number. There is no charge for copies of the student transcript. Other reproductions cost 50¢ per page. The university honors requests as long as there is no outstanding obligation to the Medical Center. Students within commuting distance may be asked to review the desired data in person.

Students may request that the university amend information in their records that they believe to be inaccurate, misleading, or that violates their privacy. If the university refuses to amend the records as the student wishes, he/she may request a hearing in order to challenge that decision. A hearing will be granted. Students may place in their educational records statements commenting upon information in the records and/or stating their grievances with a decision not to amend the record.

Administrators who maintain the records adhere to a policy of limited access for administrators and faculty of Rush University having a need for information in order for their offices to function, to determine academic progress or to designate award recipients. Other persons or organizations given access are those responsible for accrediting the institution, for providing the student with financial aid, for complying with a judicial court order and for protecting the health or safety of students in an emergency.

Any disclosure of a student's record to others not listed in these policies must have prior written consent of the student. Requests for information and letter of consent of the student are kept with the records.

A student may waive any of his/her rights under the act and its regulations.

A student may file a written complaint with the Family Educational Rights and Privacy Act Office regarding alleged violations of the General Education Provisions Act and its regulations.

Copies of the act and these written policies and procedures may be obtained from the Office of the Registrar, 101 Schweppe-Sprague.

Directory Information

Certain information is classified by Rush University as directory information: student's full name, local address and phone number, date and place of birth, home town, major field of study, year in school or class, participation in officially recognized activities, dates of attendance, degrees and awards received, previous educational institutions attended by the student and previous majors, and degrees and years earned.

Each fall quarter the Rush Student Address Book is published for student, faculty, and staff use. It contains the student's name, local address and phone number, major, and class.

At the time of commencement exercises this information is released in public announcements: student's full name, degree and major, previous institution and degree(s) and year(s) earned, and home town.

Students may restrict the release of any item of information that is considered as directory information on a form provided in the Office of the Registrar, 1 Schweppe-Sprague, on or before October 15 each year or the end of the second week of the quarter following matriculation.

Human Investigation

Any project or study involving human subjects must have approval of the Medical Center Committee on Human Investigation. Studies in the community as well as within the Medical Center must have this approval. The Office of Research Affairs handles all requests and has established the protocol for proper investigative procedures.

Expenses

Expenses listed in this section apply to third and fourth year students in the undergraduate program and all students in graduate programs. Expenses for the first years of undergraduate study will depend upon tuition, fees, room, board, and other expenses at the affiliated college attended.

All expenses listed in this section are current estimates of cost levels as of the beginning of fall term 1980. The actual charge of tuition and fees is subject to change without notice, and other budgetary costs used in the determination of financial aid eligibility may also vary somewhat. Institutions utilizing federal aid funds, including Rush, derive living expense levels based upon Bureau of Labor Statistics at the moderate level. Students receiving financial aid must conform their living expenses to these allowable budgets.

Undergraduate: The estimated expenses of a full-time single undergraduate student living on campus are as follows:

Undergraduate Costs	per quarter	per academic year of three quarters
Tuition	$1,150.00	$3,450.00
Activity Fee (Fall quarter only)	10.00	10.00
Insurance	33.00	100.00
Books and Supplies	115.00	345.00
Housing and Food (estimated campus housing expense)*	840.00	2,520.00
Transportation	70.00	210.00
Personal	230.00	690.00
	$2,448.00	$7,340.00

*Living expenses of $380.00 per month include housing, food, transportation, and personal.

Students not living on campus and those who are married or who have dependent children will, of course, incur greater living expenses.

Graduate: The estimated living expenses of a full-time single graduate student living on campus are as follows:

Graduate Costs	per quarter	per academic year of four quarters
Tuition	$1,375.00	$ 5,500.00
Activity Fee (Fall quarter only)	10.00	10.00
Insurance	33.00	132.00
Books and Supplies	115.00	460.00
Housing and Utilities	675.00	2,700.00
Food	375.00	1,500.00
Transportation	70.00	280.00
Personal	230.00	920.00
	$2,883.00	$11,502.00

*Living expenses of $450.00 per month include housing, food, transportation and personal.

Students not living on campus and those who are married or who have dependent children will, of course, incur greater living expenses.

Tuition and Fees

Undergraduate Tuition: Full-time students taking from 12 to 17 credits are assessed $1,150.00 per quarter. Part-time students taking from 1 to 11 credits are assessed $100.00 per credit. While enrolled as either part or full time, single coverage under ANCHOR is provided at no additional charge. (See Health Services for further information.)

Graduate Tuition: Full-time students taking from 12 to 16 credits are assessed $1,375.00 per quarter. Part-time students taking from 1 to 11 credits are assessed $120.00 per credit. While enrolled as either part or full time, single coverage under ANCHOR is

provided at no additional charge. (See Health Services for further information.)

Application Fee: A non-refundable application fee of $25.00 is required of all applicants to offset the expense of processing the application, evaluating credentials and maintaining a library of evaluation aids.

Readmission Fee: Students who have withdrawn or been dismissed from a program must pay a non-refundable $25.00 readmission fee. This fee helps offset the processing of the application for reenrollment, evaluation of credentials and committee review and deliberation time.

Enrollment Deposit: A $50.00 enrollment deposit is required of all students (including affiliated students) accepted for entrance in fall, prior to matriculation. This assures a place in the entering class. This deposit is non-refundable and applies toward payment of the first quarter tuition.

Activity Fee: An annual, non-refundable activity fee of $10.00 ($5.00 for part-time students) is assessed for those in the fall quarter only. This fee includes publishing of the student newsletter, *The Rush Reporter,* movies, dances, parties, game room, and other student activities administered by the Office of Student Affairs.

Microscope Rental: Microscopes are available to students for a rental fee which covers repairs or replacement as well as administration of the rental program.

Insurance: All students must have hospitalization coverage. (See Health Services for further information.)

Tuition Payment Policy

Tuition and fees are to be paid or satisfactory arrangements for payments made with the Office of Student Financial Affairs before registration is complete. Students may not attend classes until after registration is complete. Any exception to this policy must be approved in writing by the Associate Dean for Academic Support Services.

Students have the responsibility to complete one or a combination of the following courses of action on or before the first day of classes of each quarter.

1. *Pay total tuition and fees for the quarter.*
2. *Complete a Deferred Payment Plan Contract.* This plan requires that one-third tuition, all fees, and a $15.00 service charge be paid on or before the first day of classes. Additional payments of one-third tuition are due on the fourth and eighth Monday of the quarter. Forms are available in the Office of Student Financial Affairs.
3. *Complete a Financial Aid Late Payment Form.* This form, initiated by the student and completed by the Financial Aid Office, is to be filed when the student is receiving external aid and when that aid has not arrived at the university by the beginning of the term. This would occur for example, when a guaranteed loan is needed to pay tuition and the proceeds from the bank have not been received by the beginning of the quarter. For that portion of tuition and fees not covered by this external aid, the student must complete step one or two above for the remaining amount. Forms are available in the Office of Student Financial Aid.

Those students who have not made satisfactory arrangements will be given notice by mail during the second week of classes that they are delinquent in their financial obligations to the university. The notification will inform the students that they have until Friday of the third week of classes to satisfy all such financial obligations. On Monday of the fourth week of classes, those students who have not made satisfactory arrangements will be notified that their registration has been canceled for the quarter. Students who choose the Deferred Payment Plan Contract and who fail to make a payment on the specified due dates will have notification mailed to them on Monday of the following week that they are delinquent in their financial obligations to Rush University. The notice will inform the students that they have until Friday of that week to satisfy their financial obligation without penalty, and that failure to do so will result in the cancellation of their registration for the quarter.

On Monday of the following week all

students remaining delinquent under the Deferred Payment Plan will receive final notice that they have been dismissed, and that their dismissal has resulted in forfeiture of all previous payments made.

Any student dismissed under this policy will:

1. Be covered by Anchor/Blue Cross for the remainder of the quarter if the appropriate fees are paid.
2. Be dismissed from on-campus student housing.
3. Lose locker and mail privileges.

Students who are reinstated by decision of the associate dean will pay an additional fee of $25.00.

Students who wish to re-enroll the following quarter or year should contact the Registrar of Rush University.

Refund Policy

Official withdrawal from a course, or from the college, entitles a student to a refund of tuition according to the schedule listed below. No other fees are refundable.

A student may receive a 100 percent refund if withdrawal is during the first calendar week in which classes begin. Otherwise, refunds will be made as follows:

Second week—80 percent refund
Third week—60 percent refund
Fourth week—40 percent refund
Fifth week—20 percent refund
After fifth week—no refund

Students may request the refund to be shown as a credit on their account or request a check for the amount of the refund, less any amount still owed for other charges. Normally checks are processed within two weeks. Students, their parents, or their agents desiring an exception to the published refund policy may appeal in writing to Dr. John E. Trufant, Associate Dean, Academic Support Services, Rush Univeristiy, 600 South Paulina, Chicago, Illinois 60612.

Financial Aid

The purpose of the financial aid program for students of Rush University is to attempt to provide financial assistance to all admitted students in need of such assistance so that Rush University can be a viable choice of schools for *all* who desire to attend, regardless of financial circumstances. To the extent that they are able, parents and students are expected to provide a contribution toward educational expenses, the amount of which is measured under a standard set of criteria by either the College Scholarship Service or the Educational Testing Service. It is the responsibility of the Office of Student Financial Aid at Rush University to attempt to provide and coordinate various programs of financial assistance for the student to make up the difference between what it costs the individual to attend Rush University and what the family and student are reasonably able to contribute towards the student's educational expenses. We are generally able to meet demonstrated financial needs but such may not always be true for all students.

More detailed information on financial aid is provided in the Rush University Student Financial Aid Handbook, which is sent to all applicants for admissions. The staff of the Office of Student Financial Aid is available on a daily basis to consult with students and parents on all matters regarding the financing of a Rush University education. Students and parents are welcomed and encouraged to make use of these services.

Application Procedure. For a student to be considered for financial aid from Rush University and to insure that his or her potential for aid from outside sources is maximized, the student should file the following documents:

1. Rush University Financial Aid Application.
2. Financial Aid Form (FAF). *Undergraduate students only*. The FAF serves as an application for Basic Grant and for financial aid programs administered by Rush University. The code number for the College of Health Sciences is 3262.
3. Graduate and Professional School

Financial Aid Service statement (GAPSFAS). *Graduate students only.*

4. Financial Aid Transcript. *Incoming students only.* A Financial Aid Transcript must be completed by each school previously attended. Transcript forms are available in the Office of Student Financial Aid.
5. Illinois State Scholarship Commission (ISSC) Monetary Award application. *Illinois residents without baccalaureate degrees only.*
6. Guaranteed Student Loan application. Available at participating banks.
7. Applications for aid from any outside foundations or agencies for which the student might be eligible. The student should research these possibilities independently as well as in conjunction with the financial aid office.

Application Deadline. For the student to receive consideration for aid from Rush University, the above documents should be on file in the financial aid office by May 1 preceding the student's September enrollment. Late applications will be considered for assistance but generally only if funds remain after distribution to on-time applicants. Late applications not the fault of the student will be considered as if received on time. Students admitted after May 1 will be given a reasonable time to complete the application process.

Renewability of Financial Aid. The student must resubmit *all* financial aid application forms each and every year in which financial aid is being requested. Renewability will be generally contingent both upon the student's having continued financial need and the availability of funds for student aid.

Financial Aid Award. After considering the family resources and aid awarded to the student by the Basic Grant Program, Illinois State Scholarship Program, and private agencies (where applicable), the Office of Student Financial Aid will attempt to provide additional funds if further demonstrated need exists. Thus various sources of financial aid will need to be drawn upon and brought together in "packaged" form for the individual student. In varying quantities, a financial aid package may include scholarships, grants, loans, and employment.

Scholarships/Grants

Basic Educational Opportunity Grant (BEOG)

BEOG is a federal grant program based solely upon the student's financial need; it is designed to provide the first portion of an undergraduate student's aid package. Awards currently range up to a maximum of $1,800 per year. All eligible students are required to apply for BEOG before they will be given consideration for financial aid from the University. Students apply for BEOG by completing the FAF and indicating that they want their financial information released to the Basic Grant Processing Center. In reply students receive a Student Eligibility Report which must then be forwarded to the financial aid office where the amount of the award will be computed.

If the student is not eligible for an award, one copy of the SER should nonetheless be forwarded to the financial aid office as evidence of the student's having applied for the program. *Students who possess a baccalaureate degree are ineligible for BEOG.*

Faculty Wives Scholarship. A scholarship fund for Rush University students has been established by a generous contribution from the wives of the faculty. These scholarships will be awarded on the basis of academic potential and financial need.

Faculty Women's Scholarship. A generous contribution from the women of the Rush University faculty has provided a scholarship fund for female students in Rush University. Awards are based upon character, academic promise, and financial need.

Illinois State Scholarship Commission (ISSC) Monetary Award Program. This state grant program is designed to help meet the financial needs of Illinois students attending the Illinois schools. Awards currently range up to a maximum of $1,800 per year and are

based strictly upon financial need. Students apply directly to the ISSC and receive notification of status informing them of the level of their award. *Students who have completed more than 225 quarter hours of study or who have attained a baccalaureate degree are ineligible for the state scholarship program.*

Rush University Scholarships. A limited number of scholarships generally become available each year through contributions from private donors.

Supplemental Educational Opportunity Grant (SEOG) Program. A federal gift aid program distributed to undergraduate students on the basis of financial need. Only students who have *not* already received a bachelor's degree are eligible.

Loans

Guaranteed Student Loan Program: This loan program requires students to make application directly to participating lending institutions (banks, savings and loan associations, credit unions, etc.); the state and federal governments will act as guarantee agents for the funds. Eligibility for the principal of the loan is generally determined by the lending institution. Interest on the loan is paid for all students by the government while the student is in school. The annual maximums allowed under the program are $2,500 for full-time undergraduate students and $5,000 for full-time graduate students. Applications are available at the lending institutions.

National Direct Student Loan Program: A campus-based federally-funded program, wherein funds are awarded by the Financial Aid Office to undergraduate and graduate students on the basis of financial need. The principal repayment and interest charges are deferred until nine months after the student ceases attendance. Interest is at the simply compounded rate of 3 percent per annum. The loan fund under this program is a revolving fund, providing for loan repayments to become future loan funds for other needy students at Rush University.

Employment

College Work-Study Program: A federal student employment program wherein students work part-time to help meet the costs of attendance. Work under this program is approved by the Financial Aid Office and is based upon the financial need of the student.

Institutional Employment: There are some opportunities for the student to work part-time within the institution. The student should be mindful, however, that the academic workload will severely restrict and occasionally preclude one from working during the academic term.

The Graduate School

Executive Committee:

David I. Cheifetz, Ph.D., Dean
Brenda R. Eisenberg, Ph.D.
Henri Frischer, M.D., Ph.D.
Henry Gewurz, M.D.
Csaba Hegyvary, M.D.
Klaus Kuettner, Ph.D
Colin Morley, Ph.D.
Arthur V. Prancan, Ph.D.
Maxwell Rafelson, Ph.D.
Charles L. Schauf, Ph.D.
Anthony J. Schmidt, Ph.D.

Student Representatives
Dennis Fowler
Richard Zeff

The Graduate School

General Information

At the present time, the mission of the Graduate School within Rush University is the preparation of graduate students for the degree of doctor of philosophy in the basic biological and behavioral sciences. The degree of doctor of philosophy is given in recognition of high attainment in a particular field of scientific research, as evidenced by submission of a dissertation showing power of independent investigation and forming a contribution to existing knowledge.

The Graduate School faculty hopes to provide individualized and flexible scholarly paths for its students. It wishes to avoid arbitrary imposition of uniformity and the encumbrance of unnecessary formality. It is hoped such an environment will enable students to arrive at the doctoral level still invigorated by ideas. Achievement of such a climate requires adaptation to the needs of students, with the limitation in numbers of students implicit in such an approach.

Administration of Graduate School programs is based on the formation by the faculty of divisions of graduate study. These divisions may be disciplinary or multidisciplinary in character. They come into existence for the sole purpose of providing graduate education; their continued existence is entirely dependent upon their demonstrated ability to provide such education at high levels of excellence. The divisions of the Graduate School are seen as being flexible and responsive to changing needs and experiences in their areas of education. To that end, the divisions are headed by directors who serve for definite terms and whose reappointment is subject to review at periodic intervals. Each division of graduate study is responsible, through its director, to the dean and the Executive Committee, the latter being made up of directors of all graduate divisions, elected members from the graduate faculty-at-large, and student representatives, with the dean as chairperson.

Although the dean and the Executive Committee hold ultimate responsibility for programs of the Graduate School, the divisions of graduate study retain significant latitude in structuring and administering their own programs. Aside from general Graduate School requirements, the divisions may, with approval, construct such additional or more specific requirements as their faculties deem desirable. Therefore, this section of the bulletin restricts itself to the statement of general Graduate School requirements. Students interested in admission should consult the program description of the division of their interest to ascertain special divisional requirements.

Resources

Graduate students have available to them the clinical research and instructional facilities of the entire Medical Center. These include the following:

- Within an 18-building Medical Center complex, the clinical resources of Presbyterian-St. Luke's Hospital with 873 beds; a center for the elderly with 176 rehabilitation beds; clinical diagnostic laboratories; an outpatient mental health facility; and the many other clinical and administrative services associated with a large teaching Medical Center.
- The research laboratories of the Medical Center, organized around ongoing faculty and student research programs in a wide variety of biological, behavioral, medical and surgical areas of inquiry.
- The electronmicroscopy laboratory of the Division of Cell Biology.
- The research and study resources of the Academic Facility, a newly completed, $25.5 million teaching facility containing laboratories, lecture and study halls, carrels, the university library, and a communications skills center.
- The Center for Educational Resources, which supports all instructional activities for faculty and students, including the library, Learning Resource Center with its audiovisual study carrels, computer-assisted instruction, biomedical communications, and curriculum and evaluation.

- The Library of Rush University, which serves the entire university campus, is the oldest medical library in the city of Chicago. It is administered by a staff of professional medical librarians. The library has approximately 80,000 volumes, subscribes to 1,400 periodical titles, borrows documents from interlibrary loan, and processes MEDLARS, MED-LINE, and AVLINE requests for patrons. New monographs and reference books are acquired at a rate of over 2,000 each year. The library has an outstanding collection of rare medical books available for research and study.
- The Animal Resources Facility, which provides housing and laboratory services for animals required in ongoing research and teaching.
- Appropriate access to the Data Center of the Medical Center for scientific computer use. Hardware capabilities are built around an IBM 370/145 system. Software capabilities include APL, a completely interactive terminal-base language; conversational remote job entry available for program development and submission of FORTRAN jobs; International Mathematic and Statistical Library, a complete library of scientific applied mathematical and statistical routines; and other software packages developed for specific purposes, such as SSP and SPSS. By arrangement, consultative services can be obtained from Data Center personnel.
- The Electronics Facility, which serves the clinical and basic science community of the Medical Center with electronic instrumentation design and development capabilities.
- The Research Machine Shop, which provides the Medical Center with the resources necessary for the design and fabrication of experimental devices and mechanical instrumentation.

Admission

Categories of Admission: There are three categories of admission to the Graduate School: (1) degree seeking graduate students, (2) non-degree students, and (3) auditors.

Degree Seeking Students—Students with advanced degree objectives must have the following qualifications to be considered for admission:

1. They will ordinarily be expected to hold baccalaureate degrees from colleges or universities of recognized standing. Under special circumstances, individuals who do not have baccalaureate degrees will be considered for admission if they have completed studies equivalent to those required for a baccalaureate degree program at Rush.
2. They must show promise, as judged by academic performance and experience, of ability to accomplish advanced study and research and must have adequate preparation in their chosen fields of study. Applicants must submit complete official transcripts of all previous college and university studies.
3. In addition to the above general qualifications, individual divisions of graduate study may specify other qualifications or stipulate particular forms of the general qualifications. Individuals having an interest in admission as regular graduate students should inquire of the individual divisions of graduate study concerning requirements for admission.

Non-degree Students—Such students are not admitted with advanced degree objectives and are not eligible to become candidates for advanced degrees under this classification. Such students may be admitted on the basis of the educational services that can be provided them to meet their individual needs, other than degrees. A limited plan of study for credit but not part of a degree program may be developed. Such students will apply to the course director for admission to courses via the Registrar. Such students will pay tuition for all courses taken.

Auditors—Upon approval by a course director, any individual may audit a course. The nature of participation in a course by an auditor will be defined by the course director. Auditor status does not require payment

of tuition and does not confer course credit.

Non-faculty members of the administrative, instructional, technical, scientific, research, library, and patient care staffs of the Medical Center, who meet the regular requirements for admission to the Graduate School, are eligible to apply for admission as resident graduate students. The amount of graduate work such students may take will be determined by the terms of their employment. In view of the limited numbers of students admitted to regular graduate status, it must be understood that students applying for full-time residence receive priority.

Rush University faculty members holding professorial rank or classified as instructors may take graduate courses. They may also become candidates for degrees, but approval of their candidacy requires special petition to the dean and consideration by the Graduate School Executive Committee, in addition to the usual steps. In approving such candidacy, the dean will set such additional standards as suit the circumstances, in all cases including the requirement that the candidate's dissertation committee be composed equally of Rush and non-Rush professors, and that the candidate have at least one advisor in addition to his principal advisor, who is expert in the field of study concerned and is a non-Rush professor.

Concurrent Ph.D.-M.D. Programs

Rush University offers students the opportunity for concurrent studies which lead to both M.D. and Ph.D. degrees. These programs are particularly suited for students who aspire to careers in academic medicine and research and enable students to obtain intensive training in specialized areas of the biological and behavioral sciences while completing their medical studies.

The curricula for students in concurrent Ph.D.-M.D. programs vary widely depending on the individual's previous education, on the area of scientific study, and personal interests. Students in concurrent programs must meet the full conditions and requirements of the Graduate School, Graduate Division and Medical College. However, course work leading to one degree may be acceptable as partial credit toward the formal requirements of the other degree. A properly coordinated program may afford a significant economy of time in completing studies toward both M.D. and Ph.D. degrees.

A student who enters Rush University with concurrent enrollment in a graduate program and the medical college will most typically complete two years of the basic science components of the medical college curriculum before becoming fully involved with meeting the requirements of the graduate division. Upon completion of the requirements for the Ph.D. degree, the student will return for the clinical portion of the medical program. Alternatives to this schedule are possible to enable students to develop programs which will most effectively meet their career objectives. Students already enrolled in the M.D. program may apply for admission to a graduate program in the College of Health Sciences.

Currently, Ph.D. programs are offered in the Graduate School of the College of Health Sciences in the following areas: Anatomical Sciences, Immunology, Pharmacology and Physiology. Additional programs are in process of development.

Admissions Procedures—All individuals requesting applications for admission to the Medical College will automatically receive an additional form on which they may signify their desire to pursue concurrent studies leading to the M.D. and Ph.D. degrees and the Ph.D. program(s) in which they have interest. Programs in the Graduate School so designated will be notified and the student contacted about subsequent steps to be taken in completing the application for the Ph.D. program. Application procedures and divisional requirements are described below and are the same for students seeking concurrent enrollment as for those applying solely to the Graduate School. Applicants seeking concurrent enrollment will ordinarily not be granted admission to the Graduate School if they fail to gain admission to the Medical College. Students accepted for concurrent enrollment, but not immediately entering the

graduate phase of study, will be assured by the Graduate Division that laboratory facilities and supervision for dissertation research will be provided at the appropriate time of full enrollment in Graduate School studies. Advance commitment of fellowships, scholarships, assistantships or traineeships may not be possible.

Admission Requirements

Basic requirements for admission are listed below. Applicants should note that individual divisions of graduate study may have additional requirements. *In all cases*, a student considering application for admission should first establish contact with the director of the division in which he or she plans to study, to determine divisional requirements.

1. An undergraduate record of scholastic excellence is an important consideration. Irrespective of undergraduate record, the process of application review searches for evidence of a high level of creativity and scholarly potential in the applicant.
2. *Two* copies of the official transcripts of all previous college and university studies must accompany the application for admission. Ordinarily these will include official record of the award of a baccalaureate degree from an accredited school.
3. A non-refundable application fee of $25.00 must accompany the application. This fee is not refundable under any circumstance, regardless of the outcome of the application. Checks or money orders should be made payable to the College of Health Sciences. Applicants from outside the U.S.A. must remit the fee either by international money order or by a check drawn on a United States bank.
4. Undergraduate major and minor programs of studies should satisfy graduate division requirements.
5. The application must be accompanied by at least three letters of recommendation from college instructors or other supervisors of work in support of the applicant's ability to pursue a scholarly program of independent studies and research.
6. The application must be accompanied by a personal statement in which the applicant indicates his or her reasons for wanting to do graduate work and describes the relevance of his or her goals and academic training to the program into which admission is being sought.
7. Applicants are expected to have decided upon their field of study before making application for admission and to *indicate only one* graduate program on the application form. A second or dual application for a different major for the same quarter will not be considered. Individuals who are uncertain about their objectives should communicate with the director of each graduate division in which they are interested and submit the application only when a definite choice has been made.
8. A current Graduate Record Examination, testing verbal and quantitative abilities, is strongly recommended. Individual graduate divisions may make this a requirement. Information regarding testing dates and locations may be obtained by writing the Educational Testing Service, Box 995, Princeton, New Jersey 08540. GRE scores should be directed to the graduate division of application.
9. Applicants whose first language is not English, and who cannot otherwise demonstrate their competence in this language, must take the Test of English as a Foreign Language (TOEFL), administered by the Educational Testing Service in some 95 foreign centers. Applications for the TOEFL Examination may be obtained from the Educational Testing Service, Box 995, Princeton, New Jersey 08540. This is a useful, indeed important, way of helping students determine whether they are well enough prepared to undertake graduate study conducted in English before they make extensive plans for graduate study in the U.S.A.
10. An interview of the applicant may be

requested by the graduate division following preliminary review of the application.

11. In exceptional circumstances, the division may recommend waiver of a specific minimum requirement.
12. Recommendations concerning acceptance will be made to the Graduate School Executive Committee by the director of the graduate division concerned.

Admission Procedure:

1. Inquiries concerning the Graduate School should be directed to the Graduate School Admissions Office. This office will forward inquiries concerning opportunities in specific graduate divisions to the division in question. Application forms may be obtained from the Graduate School Admissions Office.

   Applicants to Graduate Divisions must submit a completed application accompanied by the following: application fee; official transcripts, or arrangements for forwarding transcripts, from all academic institutions attended since high school; three letters of recommendation from individuals familiar with the applicant's background and scientific potential, as described in the application form; a list of publications where appropriate; a description of past scientific training where appropriate; indication of forwarding of GRE scores as required; indication of forwarding of TOEFL results as required; where deemed appropriate, a letter explaining factors which may have affected past performance. Application materials should be mailed to:

   Graduate School Admissions Office
   600 South Paulina Street
   Chicago, Illinois 60612
2. In the early stages of processing the application, the student will be notified whether the application is complete or incomplete in the Graduate School Admissions Office. If it is incomplete, the missing items will be designated. If acknowledgement of receipt of application is not received within a reasonable period of time (four weeks), the applicant should inquire about the status of the admission file.

   Processing by the Graduate School Admissions Office is limited to ascertaining that the file of required materials is complete and that the applicant meets the general requirements of the Graduate School for admission. As soon as this is accomplished, all the application materials are referred to the graduate division. There they are subjected to a more specific and intensive review.
3. The graduate division will review all materials and request such additions or clarifications as may be indicated. Following such review, the director of the graduate division will recommend to the Executive Committee of the Graduate School and the dean action to be taken concerning admission of the applicant.
4. Notification to the applicant of action taken will come from the Office of the Dean. Although it is expected that applicants and graduate divisions will have extensive contact with one another, the Office of the Dean alone is empowered to make the formal offer of admission, taking the recommendations of the division and the executive committee into full consideration. The applicant should not rely upon receiving a response to the application, by way of acceptance or rejection, on or before any specific date after it has been referred to the division, nor should the applicant construe a lack of response as an intention to act favorably on the application.
5. In view of the competition for a limited number of places in the Graduate School, enrollment applications should ordinarily be completed three months prior to the anticipated date of admission to the graduate division program of choice. Applicants should determine from the director of their chosen graduate division the available entry dates. Some divisions have early dead-

lines or do not admit each quarter. However, any student applying for fall quarter admission whose application is complete by February 15, will be notified as to admission by April 15.

6. The Graduate School will consider no further applications from individuals who have made unsuccessful application for admission three times.

Ph.D. Degree Regulations

The degree of doctor of philosophy is the highest earned degree conferred by Rush University. The Ph.D. is restricted to those scholars who have demonstrated superior ability in a recognized academic discipline. The Ph.D. degree is not awarded on the basis of time spent in residence, or following the completion of any specific number of formal courses, nor is the degree granted on the basis of miscellaneous course studies and research effort. The entire Ph.D. program must be rationally related, should be highly research-oriented, and should culminate in a thesis of literary and scholarly merit which is indicative of the candidate's ability to conduct original research in a recognized field of specialization. Ph.D. programs are directed by professors who work in close association with selected graduate students. In practice, such programs are composed of formal courses, guided individual study in a chosen field or discipline, study in such cognate subjects as may be required by the candidate's advisory committee, and original research that serves as the basis of a scholarly thesis.

For the most part, specific regulations governing the process which results in final award of the degree are developed by the graduate divisions responsible for the candidate's progress. While such regulations may differ in detail from one division to another, each division's program and regulations must be reviewed for approval by the Executive Committee of the Graduate School. In all cases, graduate divisions are required to be explicit and clear about regulations that will affect the candidate. This must be stringently observed in divisional regulations concerning selection of principal advisors, advisory committees, and a plan of study. Similarly, divisions will be explicit and clear concerning procedures surrounding qualifying, preliminary, and final examinations and will also be responsible for providing the candidate with the help and information needed to plan and conduct the thesis research.

At the same time, a major responsibility of the student is to become familiar with the regulations and expectations of his or her chosen division. These regulations and expectations are included in this bulletin within the section devoted to each individual divisional program. It is considered to be the student's responsibility to remain knowledgeable about these programmatic regulations as they are set forth; they may change from time to time.

Policies and regulations applicable to all students are listed below:

General Policies:

- Rush University considers students for admission and academic progression without regard to religion, race, sex, handicap, creed, or country of national origin, and is committed to a program of equal opportunity.
- Years of residence required by divisional programs are based on the definition that a student must be registered for a minimum of three subjects in each of three quarters to satisfy the Graduate School requirement of a resident year. Graduate School residency required of all graduate students is registration as a full time student for eight quarters of at least 12 credit hours each. Unless granted a formal leave of absence, regular graduate students who fail to register for three quarters in each academic year are considered to have withdrawn from the Graduate School and must compete for readmission with all other applicants.
- For the Ph.D. degree there is no general Graduate School requirement of a foreign language. This requirement is determined by each division. Among the options decided by each division, where knowledge of another language is re-

quired, are the following: the number of foreign languages required, which foreign languages are acceptable, the type of skill required in acceptable foreign languages, whether satisfaction of a foreign language at another graduate school or at an undergraduate college is transferable, and whether a non-English native language is acceptable.

- Some divisional programs may require the student to take one or more courses at a university other than Rush. It is the responsibility of the director of the graduate division concerned to make arrangements enabling satisfaction of such course requirements and to inform the student, prior to admission, of such costs and special arrangements as may be necessary.
- The quarter hour is the unit used by the Graduate School in determining credit for courses taken at the Rush University campus. One quarter hour generally represents a lecture or seminar meeting one hour each week, or a laboratory or clinical experience of two to three hours per week (sometimes more) for the ten weeks of the quarter. Full-time graduate residence requires at least 12 and not more than 16 quarter hours per quarter. Outstanding students may petition the division director and the dean to register for additional courses. Written approval is required. Degree candidates must also obtain written permission for less than full-time residence.
- Graduate level courses taken at any recognized institution may be applied to the doctor of philosophy degree at Rush if they are judged to meet divisional requirements, subject to the approval of the major advisor and the division director. Credit in excess of nine quarter hours requires approval by the division director and the dean. Grades from courses transferred from another institution are not recorded on the student's academic record; the number of credits is recorded and added to the cumulative number of credits.
- Maximal enrollment is seven calendar years. Any approved leave of absence will be excluded from this figure. A student may petition for an extension of the overall time limit to the Division Director and the Executive Committee. If such an extension is granted, the student will be expected to enroll full-time for each remaining quarter in residence. If a student proposes to maintain active status in the Graduate School while at another location, approval by the Division Director and the Executive Committee will be necessary. Such a student will enroll each quarter with the Registrar of Rush University, for zero hours of credit, and will be charged an enrollment fee of $25.00.

Grades and good standing

- Grades used to report the quality of a graduate student's work are:

Grade	Explanation	Grade Points
A	Performance at a superior level	4
B	Performance at a level sufficiently high for a graduate degree	3
C	Performance not consistently at the level needed for a graduate degree	2
D	Inferior performance	1
F	Unsatisfactory performance	0
I	Incomplete work	—
W	Withdrawal	—
P	Passing	—
N	Not Passing	—

All required courses, as defined by each division, will be graded A, B, C, D or F. All elective courses, seminars and research courses will be graded Pass or Not Passing.

All degree-seeking graduate students are required to maintain a cumulative grade point average of 3.0 (B) for graded courses. For all courses taken Pass/Not Passing, each Division will establish a standard for the number of failures which can be received before the student is considered to be in academic difficulty.

If a student receives grades in one quarter which bring the cumulative grade point aver-

age below 3.0 (B), the Registrar will send a notice to the Dean of the Graduate School, who will place the student on Academic Probation. Such probation may extend for two quarters, during which the student must return the cumulative grade point average to 3.0.

Good standing and eligibility for enrollment in the next quarter will be lost if a student is unable to regain a cumulative grade point average of 3.0 at the end of the second probationary quarter.

In a case of loss of Good Standing the following actions can be taken:

1. Dismissal of the student for academic reasons.
2. A recommendation from the Graduate Division Director to the Executive Committee to retain the student under specific conditions. These conditions may include limited enrollment for the repetition of selected courses, or completion of new courses, or the taking of an examination, or other activities as may be judged appropriate.

If such conditions of retention are successfully met, the student will be returned to a status of Good Standing. If such conditions of retention are not met, the student will be dismissed for academic reasons. In addition, the faculty reserves the right to request the withdrawal of any student whose conduct, health, or performance demonstrates lack of fitness for continuation in the degree program.

Leave of Absence

A student who wishes to leave the school for a definite period of time may submit a written request specifying the circumstances and period of time involved to the Division Director. The director will forward the request with a recommendation to the Executive Committee for final action. The recommendation should include all conditions of the leave and of the re-entry into the program. A formal notice of Leave of Absence can only come from the Dean of the Graduate School.

Dissertation Evaluation

Review of a dissertation will follow the sequence of steps described in the manual, "Style and Form of Graduate Theses, Dissertations and Abstracts" of the College of Health Sciences. Copies of this manual are available in each Graduate Division and in the Rush Library.

Financial Affairs

Expenses. Expenses listed in this section apply to all students in graduate programs. All expenses listed in this section are current estimates of costs levels as of the beginning of Fall term 1980. The actual charge of tuition and fees is subject to change without notice, and other budgetary costs used in the determination of financial aid eligibility may also vary somewhat. Institutions utilizing Federal aid funds, including Rush, derive living expense levels based upon Bureau of Labor Statistics at the moderate level. Students on financial aid must conform their living expenses to these allowable budgets.

The estimated expenses for a full-time single graduate student living on campus are as follows:

Graduate Expenses	per quarter	per academic year of four quarters
Tuition	$1,375.00	$ 5,500.00
Activity Fee	10.00	10.00
Insurance	33.00	132.00
Books and Supplies	115.00	460.00
Housing and Utilities	675.00	2,700.00
Food	375.00	1,500.00
Transportation	70.00	210.00
Personal	230.00	920.00
	$2,883.00	$11,502.00

Living expenses of $450 per month includes housing, food, transportation and personal.

Students living off campus and those who are married or who have dependent children will, of course, incur greater living expenses.

Tuition and Fees

Tuition: Full-time students taking from 12 to 16 credits are assessed $1,375.00 per quarter. Part-time students taking from 1 to 11 credits are assessed $120.00 per credit. While enrolled as either part or full-time, single coverage under ANCHOR is provided at no additional charge. (See Health Services for further information.)

Application Fee: A non-refundable application fee of $25.00 is required of all applicants to offset the expense of processing the application, evaluating credentials and maintaining a library of evaluation aids.

Readmission Fee: Students who have withdrawn or been dismissed from a program must pay a non-refundable $25.00 readmission fee. This fee helps offset the processing of the application for reenrollment, evaluation of credentials and committee review and deliberation time.

Enrollment Deposit: A $50.00 enrollment deposit is required of all students (including affiliated students) accepted for entrance in fall, prior to matriculation. This assures a place in the entering class. This deposit is non-refundable and applies toward payment of the first quarter tuition.

Activity Fee: An annual, non-refundable activity fee of $10.00 ($5.00 for parttime students) is assessed for those in the fall quarter only. This fee includes publishing of the student newsletter, *The Rush Reporter*, movies, dances, parties, game room, and other student activities administered by the Office of Student Affairs.

Microscope Rental: Microscopes are available to students for a rental fee which covers repairs or replacement as well as administration of the rental program.

Insurance: All students must have hospitalization coverage. (See Health Services for further information.)

Tuition Payment Policy

Tuition and fees are to be paid or satisfactory arrangements for payments made with the Office of Student Financial Affairs before registration is complete. Students may not attend classes until after registration is complete. Any exception to this policy must be approved in writing by the Associate Dean for Academic Support Services.

Students have the responsibility to complete one or a combination of the following courses of action on or before the first day of classes of each quarter:

1. *Pay total tuition and fees for the quarter.*
2. *Complete a Deferred Payment Plan Contract.* This plan requires that one-third tuition, all fees, and a $15.00 service charge be paid on or before the first day of classes. Additional payments of one-third tuition are due on the fourth and eighth Monday of the quarter. Forms are available in the Office of Student Financial Affairs.
3. *Complete a Financial Aid Late Payment Form.* This form, initiated by the student and completed by the Financial Aid Office, is to be filed when the student is receiving external aid and when that aid has not arrived at the university by the beginning of the term. This would occur for example, when a Guaranteed Loan is needed to pay tuition and the proceeds from the bank have not been received by the beginning of the quarter. For that portion of tuition and fees not covered by this external aid, the student must complete step one or two above for the remaining amount. Forms are available in the Office of Student Financial Aid.

Those students who have not made satisfactory arrangements will be given notice by mail during the second week of classes that they are delinquent in their financial obligations to the university. The notification will inform the students that they have until Friday of the third week of classes to satisfy all such financial obligations. On Monday of the fourth week of classes, those students who have not made satisfactory arrangements will be notified that their registration has been canceled for the quarter. Students who choose the Deferred Payment Plan Contract and who fail to make a payment on the specified due dates will have notification

mailed to them on Monday of the following week that they are delinquent in their financial obligations to Rush University. The notice will inform the students that they have until Friday of that week to satisfy their financial obligation without penalty, and that failure to do so will result in the cancellation of their registration for the quarter.

On Monday of the following week all students remaining delinquent under the Deferred Payment Plan will receive final notice that they have been dismissed, and that their dismissal has resulted in forfeiture of all previous payments made.

Any student dismissed under this policy will:

1. Be covered by ANCHOR/Blue Cross for the remainder of the quarter if the appropriate fees are paid.
2. Be dismissed from on-campus student housing.
3. Lose locker and mail privileges.

Students who are reinstated by decision of the associate dean will pay an additional fee of $25.00.

Students who wish to re-enroll the following quarter or year should contact the Registrar of Rush University.

Refund Policy

Official withdrawal from a course, or from the college, entitles a student to a refund of tuition according to the schedule listed below. No other fees are refundable.

A student may receive a 100 percent refund if withdrawal is during the first calendar week in which classes begin. Otherwise, refunds will be made as follows:

Second week—80 percent refund
Third week—60 percent refund
Fourth week—40 percent refund
Fifth week—20 percent refund
After fifth week—no refund

Students may request the refund to be shown as a credit on their account or request a check for the amount of the refund, less any amount still owed for other charges. Normally checks are processed within two weeks. Students, their parents, or their agents desiring an exception to the published refund policy may appeal in writing to Dr. John E. Trufant, Associate Dean, Academic Support Services, Rush University, 600 South Paulina, Chicago, Illinois 60612.

Students of the Graduate School

The purpose of the financial aid program for graduate students at Rush University is to attempt to provide sufficient assistance to students to allow them to attend at the graduate level. Such assistance will generally be based upon the financial need of the student, though academic factors will be closely weighed. In addition to providing funds, certain types of assistance are intended to provide meaningful experience for the student as well as service to the institution.

Application Procedures

1. Submit a Rush University application for financial aid to the Office of the Dean of the College of Health Sciences. It will thereafter be forwarded to the Rush University Office of Student Financial Aid.
2. Submit a Graduate and Professional School Financial Aid Service statement (GAPSFAS). The Rush University code number to be used is 3263 for students in the College of Health Sciences.
3. At the option of the student, submit an application for an Illinois Guaranteed Loan. This program takes on increasing significance when federal and other programs are being funded at low levels. In this regard, the student may wish to seek counseling from the financial aid office at an early date.

Application Deadline. For the student to receive the most favorable consideration for aid from Rush University, the applications should be on file by May 1 preceding the student's fall enrollment. Late applications will be considered on a rolling basis if funds remain after the distribution to on-time applicants. Students admitted after May 1 or for enrollment other than at the beginning

of the fall term, and who have not completed the application process will be given a reasonable time to do so.

Renewability of Financial Aid. A student's financial aid will generally be renewed each quarter, if funds permit, and if the student remains in good academic standing and continues to have financial need.

Counseling Services. The Office of Student Financial Aid is available on a daily basis to assist students with financial planning and resource availability. Students are welcomed and encouraged to make use of these services.

Scholarships/Grants

The above-outlined application procedure will give the student in the College of Health Sciences Graduate School consideration for programs described below.

Broda O. Barnes Fellowship. A fellowship has been established for a deserving and meritorious student enrolled in the doctoral program of the Division of Physiology, to be awarded by the Chairman, Department of Physiology.

Broda O. Barnes Fellowship in Memory of Anton J. Carlson and Arno B. Luckhardt. A fellowship has been established for a deserving and meritorious graduate student in the College of Health Sciences, to be awarded by the dean of the College of Health Sciences.

Faculty Wives Scholarship. A scholarship fund for Rush University students has been established by a generous contribution from the wives of the faculty. These scholarships will be awarded on the basis of academic potential and financial need.

Graduate Assistantships. These represent funds generally obtained through grants to individual faculty and, as such, vary in amount from division to division, although they generally are uniform within a division.

Graduate Traineeships. Certain divisional programs with NSF training grants or NIH National Research Service Awards may from time to time have positions to be filled on such grants. In addition, graduate students may directly apply to NSF or NIH for such support. All such individuals will be classed as graduate trainees.

Rush University Scholarships. A limited number of scholarships generally become available each year through contributions from private donors.

Senior Graduate Assistantships. Upon admission to candidacy, and subject to availability of funds within divisions, graduate students may apply for these awards. Generally the intent is to supplement the stipend levels of graduate students showing unusual responsibility, promise, and ability beyond the levels provided for by the research assistantships.

Teaching Assistantships. These represent funds available to support graduate students in return for teaching services rendered to specific departments.

University Fellowships. These represent funds available to students through the College of Health Sciences. Amounts will depend on financial need and availability of funds. There will be no variation in the amount of the award between divisions.

Loans

Guaranteed Student Loan Program. This is a loan program in which students make application directly to participating lending institutions (banks, savings and loan associations, credit unions, etc.); the the state and federal governments will act as guarantee agents for the funds. Eligibility for the principal of the loan is generally determined by the lending institution. Interest on the loan is paid for all students by the government while the student is in school. The annual maximum allowed under the program for full-time graduate students is $5,000 and the cumulative maximum is $15,000. Applications are available at the lending institutions.

National Direct Student Loan Program. A campus-based federally funded loan program, wherein funds are awarded by the financial aid office to students on the basis of financial need. The principal repayment and

interest charges are deferred until nine months after the student ceases attendance. Interest is at the simply compounded rate of 3 percent per annum. The loan fund under this program is a revolving fund, providing for loan repayments to become future loan funds for other needy students.

Employment

College Work-Study Program. A federal student employment program wherein students work part-time to help meet the costs of attendance. Employment under this program is approved by the Office of Student Financial Aid and is based upon the financial need of the applicant.

Institutional Employment. Some opportunities exist for the student to work part-time within the institution. The student should be mindful, however, that the academic workload will severely restrict and occasionally preclude one from working during the academic term.

Divisional Programs

(Programs in addition to those described are in process of active development)

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Graduate Division of Anatomical Sciences

Anthony J. Schmidt, Ph.D., Director

Faculty

Andriacchi, T.	Durica, T.	Jacob, S.	Maibenco, H.
Colgan, J.	Galante, J.	Khedroo, L.	Schmidt, A.
Dinsmore, C.	Hughes, W.	Khodadad, J.	Seale, R.

Program Outline

The Division of Anatomical Sciences offers an interdepartmental program of studies in the morphological sciences, dealing with the development, organization, and function of biological structure. The curricular center is in the Department of Anatomy, whose offices and laboratories are housed in the Academic Facility. This framework is complemented by faculty with a wide range of teaching and research interests, providing opportunities for the advanced student to engage in creative scholarship in an atmosphere that fosters intellectual growth. The participating faculty is drawn from a broad sector of the biological, medical, and surgical sciences and services of the Medical Center, and specifically from anatomy, ophthalmology, and orthopedic surgery.

Facilities

Modern research and teaching areas in the Academic Facility have been designed specifically to meet the needs of both basic medical science education and research. In addition to individual faculty laboratories, a modern facility is available for transmission electron microscopy, and extensive research laboratories exist in Rawson (ophthalmology), and in Jelke (orthopedic surgery) where the gait laboratory, one of the very few such major facilities in the country is in operation.

Objectives

Graduate study is offered at the doctoral level. Progress is evaluated with respect to course work and the conduct of a thesis project. It is the purpose of the graduate study program to: 1) provide background in those courses that constitute the core of anatomy curricula in graduate and medical schools; 2) encourage conceptual development in specialized areas through elective courses in cytology, developmental biology, regeneration, biomechanics, reproductive biology, endocrinology, and neurobiology; 3) define problems which are amenable to experimental or applied studies.

Application and Admission

Applications are invited from students who have received a baccalaureate degree or prior graduate training or an advanced degree elsewhere, and who wish to pursue graduate study in the anatomical sciences at Rush University; and to the superior student enrolled in the medical curriculum or in other professional programs in Rush University.

The exceptional medical student may combine graduate studies with the Rush medical curriculum and, though possible to earn both the M.D. and Ph.D. degrees after four years of study, students will generally find it necessary to continue their graduate studies beyond the fourth medical year.

To afford students who previously have taken course work in anatomy at Rush or elsewhere the opportunity of entertaining advanced placement, the division program director and Graduate Studies Committee may (1) review the student's prior achievement in courses comparable to the formal anatomy curriculum, or (2) offer a proficiency examination in one or more courses for credit. In either case credit in excess of nine (9) quarter hours requires approval by the program director and the dean. However, under no circumstances can a student receive more than one academic year of advanced standing in the graduate program of the division. Accordingly, the student receiving advanced placement should expect to engage in graduate studies for a minimum residency of eight quarters of full time registration in the Graduate School.

The professional student must accept

responsibility for meeting all of the requirements for progress and graduation in the division's graduate studies program. These include mastering recommended course work and successfully passing the division's comprehensive qualifying, preliminary, and final examinations. In this regard individualized studies will be programmed to meet the student's need in achieving essential knowledge in preparation toward these examinations and skills for scholarly investigation.

Inquiries should be directed to:

Graduate Admissions Office
600 South Paulina Street
Room 474 M
Chicago, Illinois 60612

In addition to the admission requirements established by the Graduate School, the division asks applicants to send documents supporting:

1. An undergraduate record of scholastic excellence with a minimum of a B average or its equivalent in the major field of study. Application by students who have demonstrated a high level of creativity and scholarly potential is solicited.
2. A major, preferably in biology or chemistry, and demonstrated academic competence and motivation for a career in the morphological sciences. Undergraduate training should have included a laboratory in comparative anatomy. Courses in descriptive and experimental embryology would be helpful.
3. A current Graduate Record Examination (GRE) testing verbal and quantitative abilities, and either biology or chemistry. Exemption from the GRE may be considered at the discretion of the Graduate Studies Committee.
4. In view of the competition for the limited number of places in the Graduate School enrollment, applications should ordinarily be completed three months prior to anticipated date of admission. Summer and fall quarter admissions are preferred by the division.

The completed application initially will be evaluated by the program director and Graduate Studies Committee of the division. A personal interview may be requested following the preliminary review of an applicant's credentials. The completed application is then presented to the dean and Executive Committee of the Graduate School to determine the course of action to be taken by the Office of the Dean.

Program Leading to the Ph.D. Degree
Outline

The student must accept responsibility for meeting all of the requirements for progress and graduation in the division's graduate studies program. These include mastering recommended course work and successfully passing the division's comprehensive qualifying, preliminary, and final examinations. In this regard individualized studies will be programmed to meet the student's need in achieving essential knowledge in preparation toward these examinations and skills for scholarly investigation.

An acceptable thesis must be searched and prepared by the student. Dissertations will be developed through faculty-guided independent research projects. Interdisciplinary problems and approaches may be pursued in the laboratory, including the clinical diagnostic laboratory, and in the realm of applied biology (excluding purely clinical observation or equivalent reporting).

Course Requirements

The formal electives and dissertation requirements are as follows:

1. *Courses of Study*. A minimum of 72 quarter hours is required.

   Required: The formal courses in anatomical sciences include instruction in 1) gross human anatomy, 2) microscopic anatomy, 3) embryology, 4) neuroanatomy, 5) methods in morphological research.

   Electives: Major electives are a minimum of three advanced topics selected for personal interest and need in preparation for thesis research. These are primarily delivered as seminars, tutorials, and, in some instances, laboratory instruction.

   Minor electives are a minimum of two advanced topics in complementary areas of study.
2. *Research*: A minimum of 72 quarter hours required in pursuit of dissertation research under the guidance of a principal adviser. Additional registration is open to serve individual needs.

In addition to the formal course requirements, each student will be expected to assist in the instructional process within the Division of Anatomical Sciences thereby gaining valuable pedagogic experience. The student should participate as a teaching assistant at least once in each of the formal courses.

Also, student attendance and participation in divisional seminars is expected. This will not only expose the student to current topics in anatomical research, but will also present opportunities to discuss problems with established investigators.

Concomitant Ph.D. and M.D. Degree Programs

For the exceptional student who wishes to pursue both the Ph.D. degree and the M.D. degree during registration in Rush Medical College, the following relationship between the medical curriculum and the graduate program may be described. (In our experience, students in the Phase I and Phase II medical curriculum can devote an additional 12-18 hours contact time a week to graduate studies.)

Phase I Medical Curriculum. In the first year of study, and including the summer quarter, the student can complete all formal course requirements, gain graduate credit applicable toward satisfying the minor elective requirement, initiate a research project, and take the qualifying comprehensive disciplinary examination.

Courses: gross and microscopic human anatomy, embryology, neurobiology, biochemistry, microbiology, physiology, and elective graduate courses (63 quarter hours).

Research: may begin in the summer quarter (12 quarter hours).

Phase II Medical Curriculum. Continuing studies will provide additional graduate credits that satisfy all course requirements and broaden the student's conceptual and research experience. The preliminary examination may be taken at the end of this period.

Courses: pathology, pharmacology, immunology, genetics, and elective graduate courses (53 quarter hours).

Research: continuation of research begun earlier (9 quarter hours).

Phase III Medical Curriculum. The clerkship program of Rush Medical College is conducted in a ninety-six (96) week period following Phase II. The medical student is required to take a series of core clinical clerkships (56 weeks), followed by elective clerkships (24 weeks), and unscheduled time (16 weeks). There is flexibility within the clerkship program that allows students who are concomitantly enrolled in graduate studies to entertain the option of taking all rotating core and elective clinical clerkships in Presbyterian-St. Luke's Hospital and its vicinity, enabling them to simultaneously pursue their graduate program.

Enrollment in formal courses is not expected during the core clinical clerkships though it may be possible for students to engage in tutorials offered through *Anatomy* 556, *Concepts in Morphology* (1-3 hrs.), and

likely to continue some portion of an ongoing research program. Maximum credit students may enroll for is 6 qtr. hrs. per quarter.

It is during the elective and unscheduled periods that a student pursuing a concomitant Ph.D. degree may elect to take essential graduate courses and continue dissertation research in addition to engaging in elective clerkships to fit individual goals.

The total research credit hours (72 hours minimum) requirement may be satisfied during Phase III, and the final examination in defense of the thesis may be taken following acceptance of the dissertation by the Dean of the Graduate School.

Assessment of Progress

The student's progress will be assessed continuously based upon performance in the courses taken and upon evaluations by faculty members.

Students who fail to maintain scholastic standards of the division (GPA = B) and of the Graduate School will be placed on probation as a warning with opportunity to improve. Failure to improve for two consecutive quarters of probation may be cause for dismissal.

Qualifying Examination: At the end of the first year, each student will take a comprehensive examination covering the formal courses in the division. The format of this examination will be both a written essay and oral presentation affording the student the opportunity to demonstrate an understanding of the interrelationship of the various levels of anatomical studies. The examining committee will be designated annually by the Graduate Studies Committee. The successful completion of this examination qualifies the student to continue studies toward the doctoral degree. Failure to pass will require determination by Graduate Studies Committee, upon the advice of the student's advisory committee, of whether or not a second and final opportunity be offered the student. Upon such recommendation, a second examination may be taken at a mutually satisfactory time within six (6) months of the initial comprehensive discipline examination.

Graduate Advisory Committee

Each entering student will be guided in his or her course of studies by the program director with the assistance of the Graduate Studies Committee until such time as the student determines a course of thesis scholarship. Students will be expected to reach an appropriate decision early in their first year and no later than the final week of the fourth quarter. At this time, an advisory committee will be formed to guide and counsel the student in his/her graduate education.

The advisory committee will consist of a principal adviser, two associate advisers, and the program director, who acts as an *ex officio* adviser. The principal adviser must be an active member of the graduate faculty and will be selected on the basis of mutual agreement and scholarly compatibility between the student and the principal adviser. In the event that the student does not establish himself/herself with an acceptable adviser during the first academic year (9 months), the program director, with the assistance of the Graduate Studies Committee, will counsel the student and determine alternatives, one of which could be termination of studies within the division.

Principal Adviser. Every graduate student must have a principal adviser who is a member of the graduate faculty holding appointment in the Division of Anatomical Sciences of the Rush Graduate School.

The principal adviser's primary duty is to assist the student in planning and carrying through a program of graduate work which will fit the needs and desires of the student and at the same time satisfy division and Graduate School requirements.

The dissertation research may be guided by the principal adviser, or, in the event the thesis research is to be conducted elsewhere, the investigator responsible for the external

laboratory will become a member of the student's advisory committee with the approval of the program director and Graduate School.

Thesis Proposal and Preliminary Examination

Thesis Proposal: Following successful completion of the comprehensive discipline examination and when the principal adviser and student are satisfied that the student is able to demonstrate both integrative and analytical comprehension in his/her field of specialization, the student will prepare a written thesis proposal. This proposal will then be defended as part of an oral preliminary examination relating to the student's field of specialization.

Preliminary Examination: An oral preliminary examination will be administered by an examining committee ordinarily at or prior to the end of the second academic year and no later than the end of the third academic year following admission to the division program. The committee will examine the student's proposal in depth as well as his/her grasp of all areas relevant to the research project. Should the student fail to pass the preliminary examination, a second and final examination may be held within three months upon the recommendation of the program director with the approval of the Graduate Studies Committee. Failure to pass the second examination may be grounds for dismissal.

The examining committee consists of a minimum of four faculty approved by the program director and Graduate Studies Committee. The examining committee includes the designated principal adviser, associate advisers, and at least one extramural examiner.

Thesis and Final Examination

Dissertation: The dissertation will consist of a written scholarly work based upon an original thesis research project. It should be presented in the format determined by the Graduate School.

The scheduling of the dissertation review by the advisory committee, and by the dean, must comply with the requirements of the Graduate School.

Final Examination: The final examination may be taken upon acceptance of the dissertation by the Dean of the Graduate School, and must precede the projected date of graduation in accordance with a schedule determined by the Graduate School.

Oral defense of the dissertation serves as the final examination in partial completion of the requirements for doctor of philosophy degree.

The examining committee consists of a minimum of five faculty approved by the program director and Graduate Studies Committee. At least three examiners, including the student's principal and associate advisers, will be selected from within the division. Two examiners may be selected from outside the division preferably, though not necessarily, from outside the university. Distinguished scientists may be invited as guests of the department to examine the dissertation and to participate in the final oral defense.

Passing the final examination is based upon the recommendation of the majority of the examiners. In the event that the student fails to pass the final examination, the student may appeal to the Dean of the Graduate School who, upon consultation with all parties concerned, may recommend a course of action to be taken.

Courses Offered (For complete course descriptions, see section on course offerings, page 145.)

The following courses are fundamental to the graduate program of the division and are to be taken by all graduate students:

ANAT	455, 456	*Histology*
ANAT	471	*Human Anatomy I*
ANAT	472	*Human Anatomy II*
ANAT	451	*Neuroanatomy*
ANAT	581	*Approaches and Methods in Morphologic Research*
ANAT	591	*Preceptorials in Anatomy*
ANAT	699	*Research*

The following courses will be available, subject to demand and limitation, to graduate students within the Graduate School:

ANAT	511	*Comparative Cytology of Tissues*
ANAT	521	*Experimental Morphogenesis*
ANAT	522	*Tissue Repair and Mechanisms*
ANAT	523	*Cell Biology of Vertebrate Repair and Regeneration*
ANAT	524	*Morphologic and Physiologic Adaptations in Development, Maturity, Aging, and Injury*
ANAT	462	*Introduction to Neurobiology*
ANAT	560	*Topics in Neurobiology*
ANAT	541	*Topics in Muscle Biology*
ANAT	513	*Anatomy of the Eye*
ANAT	593	*Concepts in Morphology*
ANAT	601	*Surgical Anatomy*
ANAT	602	*Advanced Anatomy*

Graduate Division of Cell Biology

Brenda R. Eisenberg, Ph.D., Director

Faculty

Colgan, J.	Hughes, W.	Osmand, A.	Weinstein, R.
Eisenberg, B.	Khodadad, J.	Pauli, B.	Wolfe, L.
	Morley, C.	Rae, J.	

Introduction

The faculty of the Division of Cell Biology serves the following functions in the Graduate School: it constitutes a core of common interest, providing an affiliation base for increasing activity in the area of cell biology as this area expands in the university, and it develops and presents course material in cell biology to doctoral students and to other appropriate student populations. It generates and presents a discussion forum for the area of cell biology, utilizing intramural and extramural sources of expertise. It provides, through the ongoing research programs of its members, opportunity for advanced students to develop their own investigative talents. Through its director, the division assumes professional administrative responsibility for the electronmicroscopy laboratory of the Graduate School and its programs.

The Program

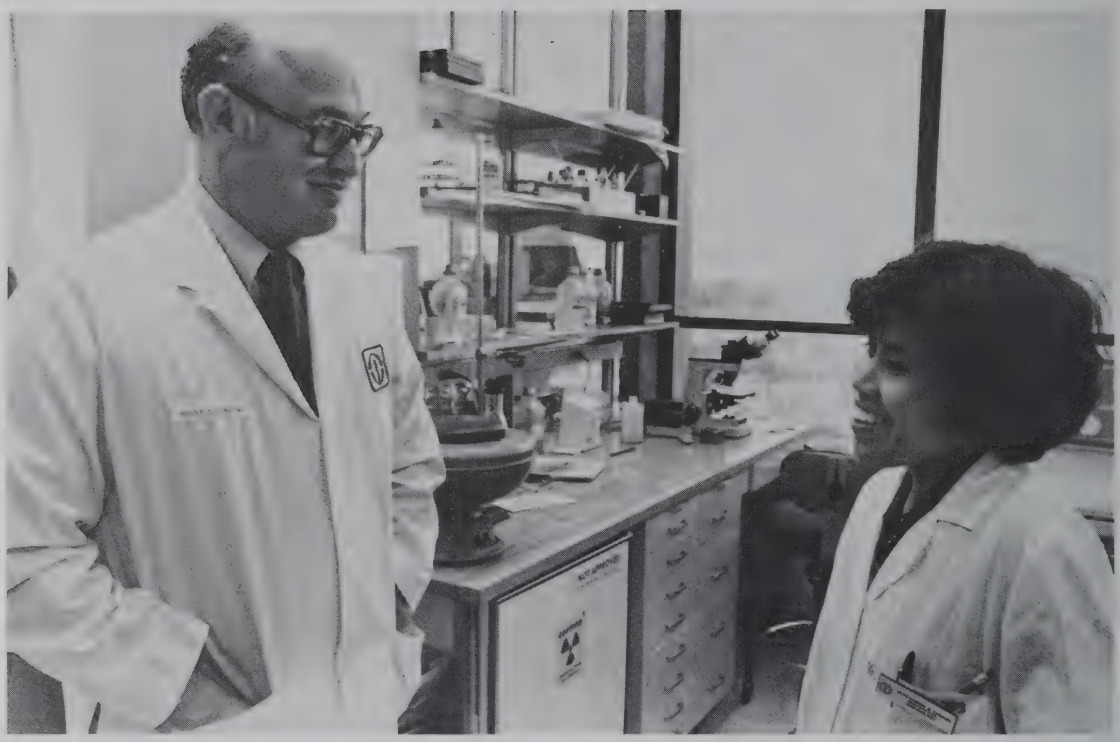
Generally, as a field of study, cell biology explores the structural organization and functional integration within cells. As a field of study, its knowledge and techniques extend to all the specialized fields of the health sciences. The purpose of this division is to supplement understanding of such basic knowledge and technique for students in the health sciences. The division encourages integration of the resources of people and facilities throughout Rush University to produce a comprehensive study of the cell. Such a purpose must be multidisciplinary, for cell biology spans many departments within Rush University, including anatomy, biochemistry, immunology, microbiology, pathology, pharmacology, and physiology.

Historically, the electron microscope has had a major impact on the growth of cell biology. The teaching of the division is centered around the electronmicroscopy laboratory of the Graduate School. Students will study the ultrastructure of the cell and its organelles in electron micrographs. But it is most important that they learn about the function of the organelles in a multidisciplinary fashion. Thus, the supramolecular structure and biochemical ultrastructure of the cell constituents are emphasized. Advanced students will learn the technical skills necessary for pursuit of research projects involving cell biological techniques. Teaching is organized with courses in cell biology and electronmicroscopy. Students taking such courses may use them as credit toward their Ph.D. requirement in other graduate divisions of Rush University, subject only to the regulations of those divisions. As an additional activity, the division sponsors a seminar series of outside speakers instituted to foster multidisciplinary exchange and to cover material not available within Rush University itself.

Courses Offered

The following courses will be available, subject to demand and limitation, to graduate students within the Graduate School. (For complete course descriptions, see section or course offerings, page 151.)

CEBIO 501	*Cell Biology*
CEBIO 505	*Seminars in Cell Biology*
CEBIO 512	*Scientific Basis of Electron Microscopy*
CEBIO 522	*Electron Microscopy Laboratory*
CEBIO 531	*Stereology*
CEBIO 533	*General Pathology*
CEBIO 599	*Independent Study*



Graduate Division of Immunology

Henry Gewurz, M.D., Director

Faculty

Baum, L.	Gewurz, A.	Jones, J.V.	Mold, C.	Plate, J.
Fiedel, B.	Gewurz, H.	Lint, T.	Osmand A.	Potempa, L.
				Thomas L.

Program Outline

An inter-disciplinary program of research and training in immunology leading to the degree of doctor of philosophy in immunology is offered by this division, which originates from and is a component of the Department of Immunology. Areas of current interest in which research training is offered include the immunobiology of the inflammatory response; the biology of the complement system, including mechanisms of activation, the control of the complement attack mechanisms and the pathophysiology of complement deficiencies; pathogenesis and immunobiology of amyloid; immunopharmacology, cellular immunology, particularly cell-mediated mechanisms in inflammation; mechanisms underlying the allergic response; immune interactions of cells and membranes; the immunopathology of coagulation; and the structure and function of the C-reactive proteins and other molecules associated with the acute inflammatory response. The application of basic research to questions of human health and disease continues to be a general commitment of the faculty of this program.

Facilities

The participants in this program are drawn from a university faculty based in an active Medical Center dedicated both to patient care and to the support of clinical, biomedical, and basic biological research. The contributing faculty is well equipped with both teaching and laboratory facilities for research in immunology.

Objectives

The objectives of this program are to provide an environment for each student to learn to the limits of his/her ability, and to train independent investigators able both to conduct original research in immunology, and, as scientists and teachers, to effectively communicate and impart their knowledge.

The program is directed toward the Ph.D. degree. The degree will be awarded by the university upon the satisfactory completion of the academic program and the submission, presentation and defense of a dissertation demonstrating the ability of the student to perform and present original scientific work. In addition, the student is required to pass an oral examination based on thesis research and related areas of science, and must satisfy the examiners that a broad conceptual understanding of the field of immunology has been reached.

Application and Admission

Students who have recently received the baccalaureate, masters, or doctoral degree may apply. Although not essential, it is recommended that students wishing to enter the immunology program should have achieved a high level of competence in biology, mathematics, and chemistry. It is important that applicants be adequately prepared to engage directly in graduate study and research.

Although there is no deadline for applications, candidates are encouraged to seek admission for the fall quarter; applications received prior to March 1 will be processed by April 1. Inquiries should be addressed to:

Graduate Admission Office
600 South Paulina Street
Room 474M
Chicago, Illinois 60612

Applicants should send the following documents to the Graduate School admissions office:

1. Complete application forms from the Graduate School of the College of Health Sciences, Rush University.
2. Letters of recommendation from three or more sponsors, preferably faculty

members of the student's current or recent college, who can assess the applicant's potential for independent graduate study and research. The sponsors should be made aware of the nature of the program for which entry is sought.

3. Official transcripts of all graduate and undergraduate studies undertaken by the applicant.
4. An outline of any relevant research or teaching experience.
5. A personal statement in which the applicant indicates his or her reasons for wanting to do graduate work in immunology in this program and describes the relevance of his or her goals and academic training to this program.

Although not required, the Graduate Record Examination is strongly encouraged as an additional credential and the results of this should be submitted.

Applicants for admission to the program will be evaluated initially by the Director for Admissions, the Program Director and the Office of the Dean of the Graduate School. Additional information may be requested prior to evaluation by the full faculty of the immunology division. Considerations for admission will include overall academic record, the recommendations of the sponsors, and the description of the applicant's own aspirations and interests. Personal interviews may be requested of an applicant still under consideration after preliminary screening. Students will be admitted into the program at levels other than first year only under exceptional circumstances; this requires recognition by the Admissions Committee and acceptance by the Graduate School executive committee that graduate training already undertaken by the student elsewhere is of a suitable standard, and that the student has reached the required level of competence in the areas of relevance to the proposed investigation. However, credit for research hours will not be allowed.

Program Leading to the Ph.D. Degree

A minimum of three years full-time (four quarters per year) study and research, or equivalent in part-time, is required to satisfy the residency requirements of this program. Students are expected to study and learn to the limits of their ability and achieve an understanding of all major areas of immunology. Training is available to allow the students to develop a competence in clinical laboratory immunology.

Upon admission to the program, each student will be assigned by the Program Director an individual tutor, who will be responsible for guiding the student's academic activities during the first 6 to 12 months. The selection of a principal advisor for thesis research should be made during this interval. During the first 12 to 24 months the student will carry an academic program designed for his or her own requirements through frequent discussion with the student's tutor and principal advisor, and with the Graduate Advisory Committee (see below), that should provide the student with a thorough grounding in immunology and appropriate related basic sciences and practical experience in several laboratories of the division faculty. With the exception of prescribed seminars, tutorials, and occasional courses, students will devote themselves full-time to thesis research following successful completion of courses and acceptance of a thesis proposal. The research program will be carried out under the guidance of a designated principal advisor and a thesis committee. Following agreement by the student, advisor, and thesis committee that a suitable stage in the research program has been reached, the student will prepare and present a dissertation demonstrating the ability to carry out a research program and perform an original contribution in the area of investigation.

Course Requirements

Although there are no formal course requirements, passage of the preliminary examination as partial fulfillment for entrance into candidacy for the Ph.D. degree, is dependent upon demonstrated competence in the field of immunology. This can be achieved by participating in a recommended core program of lecture and tutorial courses of both a basic and advanced nature (see "Course Offerings" below) which may be supplemented by independent study. Other requirements, as specified by the student's thesis advisory committee, may be met by completion of lecture, tutorial, or laboratory courses in other divisions of the Graduate School. In particular, understanding of basic biochemical concepts is paramount and will be evaluated on the preliminary examination along with the topics presented in the core program; courses in microbiology, cell biology, pathology and statistics are considered as relevant to a training in immunology, and are available as part of the student's academic program, but are not considered essential for all students. It is anticipated that courses in some subjects considered essential for a particular student's academic program will not be available in the Graduate School. Such requirements may be met either by special arrangement with the faculty of other institutions, or by enrolling in or auditing such courses available at other institutions within the geographical area. Faculty assistance in the identification of these courses and supporting tutorial instruction will be arranged. Involvement also is required in the Department of Immunology research conferences, journal clubs, and tutorial discussions, as may be specified from time to time by the Graduate Advisory Committee.

Assessment of Progress

The academic progress of each student is continuously assessed by each faculty member with whom the student has worked. The use of conventional examinations or tests is encouraged but is not required, and instructors are free to use whichever system of assessment they wish to apply, provided their criteria are made explicit.

Evaluation of the overall progress of a student is based on tri-annual reports from the tutor or principal advisor, the thesis advisory committee, and the student. The report describes the status of the academic program and the progress of research and laboratory activities, and identifies projected requirements for the remainder of the program. Students are graded in accordance with the regulations of the Graduate School, although, in addition to a transcript, a statement of progress is compiled from the student and faculty reports and this is submitted together with grades to demonstrate the student's successful progress.

It should be stressed that the purpose of such assessment and examination is primarily to aid the student in achieving academic goals by determining depth of understanding of the several areas of study, and, when necessary, identifying problems in order to enlist the aid of other faculty to assist the student in his or her training. Considerable importance in this continuous assessment is placed on the student's ability to communicate. Guided development of the skills required for both literary and verbal presentation of knowledge and ideas, as well as their formulation, is an important responsibility of the faculty in this program.

Graduate Advisory Committee

A committee consisting of four or five faculty members, including the chairman of the Department of Immunology and the Program Director, shall be responsible for the administration of this program. The role of this committee is to assist each student in the design of an appropriate academic program; to guide both the student and faculty in the selection of advisors and in the appointment of the thesis advisory committee; and to ensure the continued satisfactory progress of the student and initiate any necessary

changes or additions of this program. The Graduate Advisory Committee also shall review tri-annually the progress of each student throughout the program and shall appoint a thesis examination committee for each student and review the recommendations of this committee. The Graduate Advisory Committee shall report annually to the faculty of the division on the progress of each student.

Thesis Advisory Committee and Thesis Proposal

It is expected that within 9-12 months of admission the student shall have identified an area of specialization and a principal advisor with whom to carry out his or her research activities. Prior to proceeding with the research program and within 18 months of admission, the following requirements must be met and accepted by the Graduate Advisory Committee:

1. Formation of a thesis advisory committee that shall have at least four members: the principal advisor, two faculty members, and one other individual with recognized expertise in the candidate's field of interest, who is selected jointly by the candidate and principal advisor. This individual should be a faculty member of an institute of higher education, active in research in the area of investigation and should demonstrate willingness to maintain active contact with, and advise, the committee and student concerning the progress of research training for the duration of the candidacy. When additional advisors are required, these also shall be members of the thesis advisory committee. The chairperson of this committee shall be an active member of the Department of Immunology.
2. Acceptance by the thesis advisory committee of a thesis proposal for a research program that should constitute a scholarly outline of work leading to a contribution to existing knowledge. The proposal should include an extensive review of the relevant literature, and a detailed outline of the proposed research demonstrating an understanding of the technical and theoretical aspects of the experimental protocols. The student will be required to defend this proposal before the thesis advisory committee and, if indicated, the Graduate Advisory Committee.

   Successful completion of course work identified in the student's academic program, and adequate performance in an oral and/or written preliminary examination, administered by the Graduate Advisory Committee, should be attained within 24 months of admission.

Thesis

Following admission to candidacy the students shall devote themselves full-time to research activities under the guidance of the principal advisor and thesis advisory committee, and shall be actively involved in all the scholarly pursuits of the Department of Immunology, including tutorials, seminars, and journal clubs. Students are expected to seek opportunities to gain experience in teaching and, where possible, to be maximally involved in the teaching activities of the faculty, to the extent that this does not interfere with the progress of the research program.

Following at least six quarters of research activity and agreement by the student and thesis advisory committee that research progress is such that a dissertation may be prepared and presented, the Graduate Advisory Committee shall be notified. At least three months prior to the expected date of completion, a timetable will be set by the Graduate Advisory Committee providing a deadline for submission of the thesis and times for presentation and defense of thesis. Additional examinations also may be required and a timetable will be established for these.

A thesis examination committee will be appointed for each candidate by the

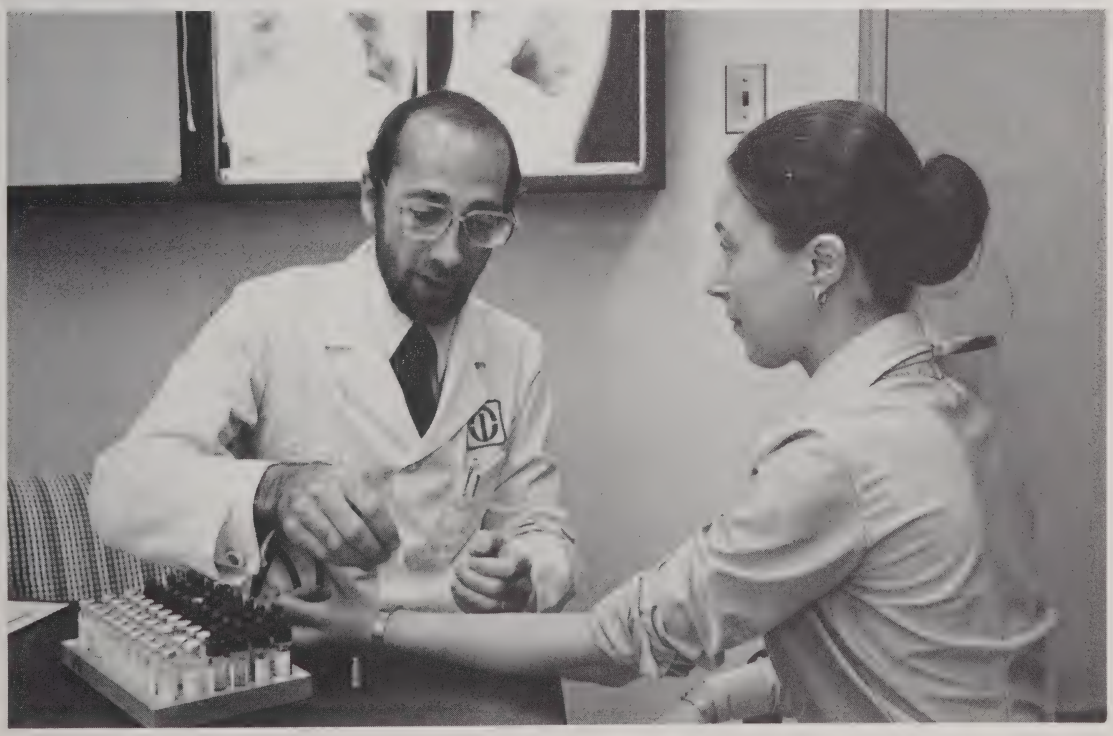
Graduate Advisory Committee with the approval of the Graduate School Executive Committee and the dean. The committee shall be composed of the thesis advisory committee of the student and any additional members of the faculty of the Graduate School who are deemed appropriate. In addition to their evaluation of the thesis, the examining committee, through consultation with the Graduage Advisory Committee, may request evaluation of the written dissertation by at least one scientist (external examiner) of international stature in the field of investigation who is not affiliated with Rush University.

Recommendation to the university for the award of the degree of doctor of philosophy is made on the basis of scholarly achievement and research ability. The role of the thesis examination committee is to evaluate the student based on the following:

1. Presentation and general defense of the scientific basis of the dissertation in an open lecture;
2. Reports of any external examiner(s) concerning the standard of scholarly research presented in the dissertation; and
3. An oral defense of thesis before the examining committee and approval of the written thesis.

The thesis examination committee may request additional examination of the student or evaluation of the dissertation and submit its recommendations to the Graduate Advisory Committee, which, upon agreement that the student has satisfactorily met the requirements for the award of the degree, communicates its recommendations to the Graduate School.

If within 10 quarters of research activity the student has not submitted a dissertation or the thesis advisory committee has failed to notify an intent to submit a dissertation, the Graduate Advisory Committee may assume the role of thesis advisory committee to evaluate the progress of the student and suggest alterations that would enable candidacy requirements to be completed within one calendar year.



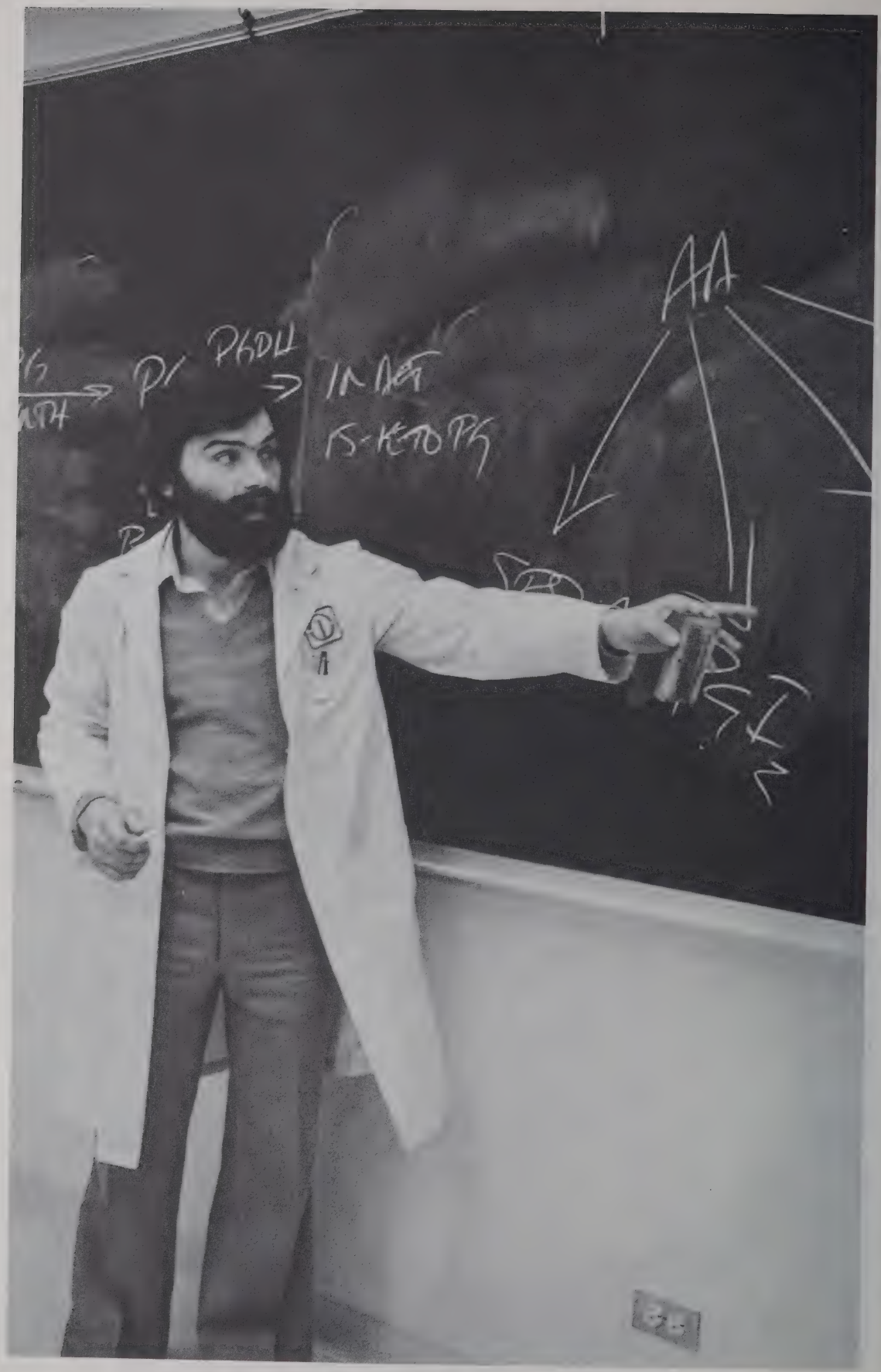
Course Offerings

A core program of lecture and tutorial courses encompassing major aspects of immunology is offered and recommended for students within the Division during their first two years, to be taken concurrently with laboratory tutorials and prethesis research:

1st/2nd Year	
(A) offered during 1980-81	
(B) offered during 1981-82	
	Fall
	IMMUN 521 *Basic and Clinical Immunology Lecture*
	IMMUN 522 *Basic and Clinical Immunology Tutorial*
	Winter
A	IMMUN 541 *Structure and Immunobiology of Membranes*
A	IMMUN 531 *Cellular Immunology I*
B	IMMUN 543 *Molecular Immunology*
B	IMMUN 553 *Immediate Hypersensitivity and Inflammation*
	Spring
A	IMMUN 532 *Celular Immunology II*
A	IMMUN 545 *Complement*
B	IMMUN 551 *Phagocytosis and Host Defense*
B	IMMUN 561 *Clinical Immunology*

OFFERED EACH TERM
IMMUN 571 *Laboratory Tutorial*
IMMUN 590 *Special Topics*
IMMUN 598 *Pre-Thesis Research*
IMMUN 599 *Independent Study*
IMMUN 690 *Special Topics*
IMMUN 698 *Independent Study*
IMMUN 699 *Thesis Research*

Other electives may be available on a regular basis to certain students within the Graduate School, subject to limited enrollment, and are offered as special topics courses or as electives such as IMMUN 603 Advanced Immunogenetics. For complete course descriptions, see section on course offerings.


AA

Graduate Division of Pharmacology

Arthur V. Prancan, Ph.D., Director

Faculty

Carson, P.
Ebersman, D.
Ecanow, B.
Frischer, H.
Hegyvary, C.
Klawans, H.
MacLeod, C.
Moon, B.
Morley, C.
Nausieda, P.
Parkhurst, G.
Prancan, A.
Trenholme, G.
Weiner W.

Introduction

The Division of Pharmacology offers study and research programs leading to the degree of doctor of philosophy. The division is composed of faculty members active in basic medical research, pharmaceutical sciences, and clinical investigation. Such diversity of interest allows this division to design doctoral programs that can satisfy the needs and desires of students interested in most aspects of pharmacology. A program of study has also been created for students who wish to enroll concurrently in this division and in Rush Medical College. The goal of this division is to provide excellent research opportunities for students. Each student will have the opportunity to participate in research of the most basic chemical nature and in research aimed at solving disease problems. Emphasis will also be placed on the development of drug analysis methods both for research and as a practical laboratory problem in a service setting, especially as related to drug trials and other areas of clinical investigation.

Research experience is being offered in the following general areas: drug effects on cellular metabolism, drug metabolism, pharmacogenetics, cardiovascular pharmacology, biochemical pharmacology, neuropharmacology, and clinical pharmacology. Current research projects that may be available to graduate students in the Division of Pharmacology include: mechanism of action of various redox drugs as investigated by studies of red cell metabolism; hereditary and acquired disorders of the pentose phosphate pathway, glycolysis, and hemoglobin; parkinsonism and related disorders; slow acetylation as related to drug effects and disease such as lupus erythematosus; clinical drug testing (Phase I and II); analgesic properties of physostigmine in relation to the morphine receptor theory; pharmacology of propranolol; pharmacology of primaquine; clinical pharmacology of methotrexate; prostaglandin metabolism in endotoxin shock; detection of circulating bacterial antigens; and clinical pharmacology of new antibiotics.

Students who wish to participate in this program ordinarily will have received at least a baccalaureate degree from an accredited American college or an equivalent degree from a foreign institution.

Admission

In addition to the basic requirements established by the Graduate School, the Division of Pharmacology has the following requirements for admission to its program. The academic experience of the student will usually include an undergraduate grade point average of 3.0 overall (four point scale), with a 3.5 average in science courses. Recommended courses include calculus, college physics, organic chemistry, and physical chemistry. Students with deficiencies in basic course work can be admitted to the program. However, for any such applicant, the division will retain the right to require extra course work that will then be considered a prerequisite for admission to candidacy for the Ph.D. degree.

The Graduate Record Examination is not required by the division, although it is highly recommended that applicants take the verbal, the quantitative, and the appropriate advanced tests. Further information regarding the GRE may be obtained by writing the Educational Testing Service, Box 995, Princeton, New Jersey 08540. The scores should be directed to the Division of Pharmacology.

Applications for admission will be accepted by the division for all quarters of the year. Incoming students with undergraduate

experience, but no graduate training, should consider applying only for the fall quarter, due to the scheduling of the basic required course sequence. Such applications will be accepted until February 15 and a decision will be sent to the applicant before April 15. Later applications for the fall quarter may be accepted if space is available. Students with research experience can begin graduate studies during any quarter of the year, and such applicants should expect to continue their research or begin an active research program within the division at the time of their admission. In either case, early application is recommended because of the small number of places available.

Applications will be evaluated by the pharmacology division director and by the division admissions committee. The admissions committee will base its recommendation regarding admission of the applicant on several factors. All prior academic experience and the letters of recommendation will be evaluated for an indication of the applicant's potential for success in graduate studies. The statement by the applicant, describing his or her own goals and motivation, will be studied to determine the compatibility between the applicant's goals and the capabilities of the graduate program. With rare exceptions, all applicants will be required to appear for an interview with faculty members in the Division of Pharmacology before admission to the program. A recommendation from the division regarding the applicant's admission will be presented to the dean and the Graduate School Executive Committee for final approval. Inquiries, other than requests for application materials, should be addressed to Arthur V. Prancan, Ph.D., Graduate Program Director, Division of Pharmacology, College of Health Sciences, Rush University, 1753 West Congress Parkway, Chicago, Illinois 60612.

Ph.D. Degree Program

Outline. This program is based on a study and research schedule that should be completed within three to six years of full time study. The minimal residence requirement established by the Graduate School is eight quarters of full time enrollment. During the first year the student will usually be committed to completing required course work and deficiencies, if any. Elective courses in other divisions will be available throughout the program. During the second and later years, required courses will be completed and the student will be encouraged to enroll in appropriate advanced courses within this and other divisions of the Graduate School. Research will ordinarily begin during the first year and will continue as the primary activity throughout the second and later years.

Required Courses. The required courses for all graduate students in pharmacology will be advanced biochemistry, medical physiology, biostatistics, medical pharmacology, advanced pharmacology, pharmacokinetics, laboratory instrumentation, and seminar. The specific course numbers are:

BIOCH 461
BIOCH 462
BIOCH 463
PHYSO 451
PHYSO 452
PRMED 531
PRMED 532
PHARM 501
PHARM 502
PHARM 503
PHARM 504
PHARM 521
PHARM 531
PHARM 691

For students who have already taken these courses elsewhere, the recommendation of the present course director and evidence of satisfactory performance in the course, may allow the division to consider the requirement satisfied.

Academic Advisor, Major Advisor. The graduate program director will function as the academic advisor to the student during the first year. The director will, during this time, determine the course schedule with the

student and monitor the student's progress. Beginning in the first year, the student will be expected to gain laboratory experience. This activity is intended to lead to the definition of research interests and to the selection of a major advisor. The major advisor, a faculty member in the Division of Pharmacology, will then accept the supervisory role in the development of the student as a scientific investigator.

Advisory Committee. Once a major advisor is chosen, this person and the student will assemble an advisory committee. The committee will consist of five Graduate School faculty members, no more than four to be from the Division of Pharmacology, including the major advisor, who will serve as chairman. This committee will be responsible for adapting continued course work to the student's needs and for providing advice and evaluation at all points in the graduate education experience. Specifically, the committee will evaluate the dissertation protocol, the dissertation, and performance at the dissertation defense.

Comprehensive Qualifying Examination. Toward the end of the second year the student usually will be expected to take the comprehensive qualifying examination. This examination can only be given with the recommendation of the advisory committee after elimination of all deficiencies and completion of all required courses. The examination is designed to test general knowledge in pharmacology and it will be administered by the Division of Pharmacology faculty. The level of performance on this examination will determine if the student is admitted to candidacy for the Ph.D. degree. Students who are unsuccessful in gaining admission to candidacy for the Ph.D. degree may retest one time only, six to twelve months after the original examination date.

Dissertation Research. Before the specific dissertation research is begun, a detailed dissertation protocol, including a literature review, must be presented to the advisory committee. At this time the student will be required to orally defend the research proposal by demonstrating an understanding of its goals and of the methods used to achieve those goals. When the committee is satisfied that these qualifications have been met, it will recommend that the student begin the research project. Although the research will be closely supervised by the major advisor, the student will be expected to accept the responsibility for attainment of the research goals.

Once the research is complete, the student will present a reading copy of the dissertation to the advisory committee for its evaluation and comments. The committee will be responsible for offering suggestions to the student on how the work may best be presented in a dissertation. Following this advice, the student will complete the dissertation and will make a formal presentation of it to the advisory committee as the dissertation defense.

The awarding of the Ph.D. degree will indicate the demonstration of a capability for independent research and represent a contribution to scientific knowledge, as judged by the advisory committee, the division faculty, the dean, and the executive committee.

Ph.D.-M.D. Degree Program

The graduate program in pharmacology will be offered in the form described below to the student who has been admitted to the graduate program in the Division of Pharmacology, who has been admitted to Rush Medical College and who elects to begin both programs of study in the same year. During the first two years, the student will complete the required courses in the pharmacology graduate program as well as the regular medical college curriculum for that period of time.

The student will then interrupt Rush Medical College enrollment and concentrate full-time on graduate studies in the Division of Pharmacology. When the graduate work is complete the student will continue with the clerkship program in the medical college.

The student will be strongly encouraged to begin a research program during the summer before coursework begins. Research can be included in the curriculum at any time.

Without added enrollment in research or elective courses the student will have completed four full-time quarters of course regis-

tration during the first and second years. The remaining four quarters of full-time enrollment will be completed during the third and later years, to satisfy this division's residency requirement. Although it is technically possible to meet the 8 quarter residency requirement within the first two years, completion of graduate studies in pharmacology may take two or more additional years.

Students who are admitted to the Division of Pharmacology graduate program and to Rush Medical College, but who do not begin these study programs at the same time, may also benefit from this combined curriculum. An individual study program which includes available aspects of this curriculum can be designed for such students.

Students who enter this program are subject to the full conditions and requirements of the Division of Pharmacology graduate program.

First Year

Summer				**Fall**			
Graduate School				*Medical School*		*Graduate School*	
Research	12			Gross & Microscopic Anatomy	140		
Total Credits	12			*Physiology	75		5
				Behavioral Sciences	23		
				*Biochemistry	40	*Biochemistry	3
						*Statistics	3
						*Seminar	1
				Total Hours	278	Total Credits	12
Winter				**Spring**			
Medical School		*Graduate School*		*Medical School*		*Graduate School*	
Gross & Microscopic Anatomy	140			Microbiology	60		
*Physiology	70		5	Neurobiology	80		
Behavioral Sciences	26			Behavioral Sciences	30		
*Biochemistry	42	*Biochemistry	3	Preventive Med.	33		
		*Statistics	3	*Biochemistry	37	*Biochemistry	3
		*Seminar	1			*Instrumentation	3
						*Seminar	1
Total Hours	278	Total Credits	12	Total Hours	240	Total Credits	7

*Required course, Division of Pharmacology.

Enrollment in research will not be required during the fall, winter and spring quarters, but a student may elect to do so.

Elective courses will be available to the student during the first year.

The biochemistry courses will be supplemented with tutorials or other additional experience for students in this program.

Second Year

Summer				**Fall**			
Graduate School				*Medical School*		*Graduate School*	
Research	9			Pathology	90		
Elective	3			*Pharmacology	50		4
Total Credits	12			Immunology	60		
				Genetics	35		
				Behavioral Sci.	32		
						*Seminar	1
				Total Hours	267	Total Credits	5

Winter				**Spring**			
Medical School		*Graduate School*		*Medical School*		*Graduate School*	
Pathology	90			Pathology	36		
*Pharmacology	51		4	Clinical Patho-physiology	150		
Clinical Patho-physiology	50			O&C/Clinical tutorial	80	Pharmacology	2
O&C/Clinical tutorial	78			Pharmacology	19	*Advanced Pharmacology	4
		*Pharmaco-kinetics	3			*Seminar	1
		*Seminar	1	Total Hours	285	Total Credits	7
Total Hours	268	Total Credits	8				

*Required course, Division of Pharmacology.

Enrollment in research will not be required during the fall, winter and spring quarters, but a student may elect to do so.

Elective courses will be available to the student during the second year.

Full-Time Graduate School Enrollment

After the second year the student will begin full-time enrollment in the Graduate School, and the clerkship program in Rush Medical College will be delayed until the graduate work is complete. During this time, the student will complete the required coursework, enroll in advanced or elective courses, pass the Comprehensive Qualifying Examination, present and defend a suitable dissertation protocol, complete dissertation research, and present and defend and acceptable dissertation. The Ph.D. degree will be awarded by the College of Health Sciences upon the successful completion of this training program. The student will then continue with the clinical curriculum of Rush Medical College.

Pharmacology

The following courses will be available, subject to demand and limitation, to graduate students within the Graduate School. For complete descriptions, see section on course offerings, page 161.

PHARM 501 *Medical Pharmacology*
PHARM 502 *Medical Pharmacology*
PHARM 503 *Medical Pharmacology*
PHARM 504 *Advanced Medical Pharmacology*
PHARM 521 *Laboratory Instrumentation*
PHARM 541 *Research in Blood Genetics and Pharmacogenetics*
PHARM 598 *Research in Pharmacology*
PHARM 603 *Biochemical Pharmacology*
PHARM 604 *Neuropharmacology*
PHARM 605 *Animal Models in Neuropharmacology*
PHARM 621 *Cardiovascular-Renal Pharmacology*
PHARM 622 *Clinical Pharmacology and Therapeutics*
PHARM 631 *Cardiovascular Experimental Methods*
PHARM 641 *Pharmacogenetics*
PHARM 691 *Pharmacology Seminar*
PHARM 699 *Dissertation Research*

Graduate Division of Physiology

Charles L. Schauf, Ph.D., Director

Faculty

Cohen, F.	Gottlieb, G.	Levett, J.	Pencek, T.
Donaldson, S.	Hegyvary, C.	Lewis, C.	Rae, J.
Eisenberg, B.	Heyer, C.	Mathias, R.	Rovick, A..
Eisenberg, R.	Hoeppner, T.	Michael, J.	Schauf, C.
			Zimmerman, R.

Introduction

The Graduate Division of Physiology of Rush University offers a program of largely independent study and research leading to the degree of doctor of philosophy. Advanced research training is offered in the fields of membrane structure and function; electrical properties of cells and tissues, including both peripheral nerve and muscle; synaptic physiology; neurophysiology and neurobiology; cardiovascular physiology, including cerebrovascular control; and active transport processes. More detailed descriptions of the research activities of the division may be requested from the division director.

Students who desire to specialize in this program are strongly advised to obtain a broad scientific foundation, including work in the related sciences. Courses in some or all of the following fields are suggested for attainment of this objective: physics, including electronics; chemistry, including physical chemistry; mathematics, including differential equations; molecular and cell biology.

Candidates for admission to the graduate program should address their inquiries at least three months in advance of the date for which admission is sought to:

Graduate Admissions Office
600 South Paulina Street
Room 474M
Chicago, Illinois 60612

The Program

Admission

Applicants for admission to the division will be initially evaluated by the director and advisory committee. Considerations will include overall academic record, evidence of previous ability to pursue successfully independent studies, recommendations of the applicant's undergraduate faculty, and the description of the applicant's scientific research interests. The program director also will determine whether additional supporting evidence would aid evaluation of the application and, if so, make appropriate arrangements with the applicant.

An applicant who holds a degree from an accredited institution will be considered for admission on the basis of (1) an undergraduate record of superior quality demonstrating proficiency in quantitative science, (2) a well-organized plan for graduate study and research compatible with expertise in the division, (3) recommendations from at least three college faculty members acquainted with the character and ability of the applicant to function in a program stressing an independent approach to the acquisition of knowledge, and (4) other materials as may be required by the program director. The Graduate Record Examination is recommended, but is not required. Except in unusual cases, the minimum prerequisites for admission will be the attainment by the applicant of a 3.0 overall average (4 point scale) in undergraduate studies with a 3.5 average in science courses preferably including the following: two years of physics or engineering; inorganic and organic chemistry; physical chemistry; advanced calculus; ordinary differential equations; cell biology or cell physiology.

Applications judged by the program director to demonstrate satisfactory credentials and interests compatible with the research facilities of the faculty will then be evaluated by all faculty members with expertise in the area(s) of interest of the applicant. Considerations in this phase will include not only

academic ability, but also the resources available to support research in the indicated area. An interview may be requested. Ultimately, selection of applicants will be by invitation of a faculty member in the division willing and able to serve as the student's principal advisor and research sponsor, after endorsement of the selection by the program director, Executive Committee of the Graduate School, and the dean. In special circumstances, exceptions to this procedure may be made for students with unusual promise, but with no firm commitment to a particular area of research. In such case, the program director will serve as interim principal advisor. Finally, in the case that the program director would be the principal advisor of a student, the physiology department chairperson shall assume the duties of program director with respect to that student.

Course Requirements

All students admitted to the division will be required to enroll in the medical physiology course as soon as possible after admission. The course will be supplemented in certain areas by an extensive outside reading list and/or special tutorial study with the faculty. In addition, each incoming student will also be expected in the first two years to enroll in at least seven courses, each involving tutorial study with one or more members of the faculty.

The student and his or her principal advisor (in consultation with the program director) will choose courses based in part on the student's previous formal training in subjects deemed essential to work in his area of interest. Most students will be required to select a minimum of seven courses from among those described in the course offerings of the Division of Physiology, but this requirement may be increased at the discretion of the principal advisor and program director.

It is anticipated that, occasionally, courses deemed essential to the student's graduate training by the division will not be available in the division of physiology or other divisions of the Graduate School. In this case, arrangements will be made for the student to enroll in such courses at neighboring institutions and performance in these courses will be required to be at the same level as for courses at Rush. In certain circumstances, a program of supervised independent study may be recommended as an alternative to particular course work.

The complete course plan, outlining all courses to be taken at Rush or elsewhere, will be prepared and signed by both the student and the program director before the end of the first quarter of residence.

Each student shall be required to pass a comprehensive preliminary examination which will insure a minimum necessary level of familiarity with modern physiological research. This examination will be arranged by the student and program director no later than 18 months after admission to the division.

Exceptions to the foregoing course requirements may be made by the program director in some instances for students entering the program with a post-baccalaureate degree and/or evidence of previous successful completion at other institutions of courses judged to be comparable to divisional required courses. Individual course requirements may be exempted on the basis of a past academic record, by the successful completion of a special examination covering the content of the required course, or in unusual circumstances by the successful completion of the preliminary examination itself. Such exemptions will not be made automatically solely on the basis of a past academic history but will be carefully judged on an individual basis by the program director and advisory committee. Recommendations for exceptions made by the program director must have the approval of the dean.

Thesis Proposal

Upon admission to the division, the student and his/her principal advisor shall begin to make preparations for a proposal upon which the student's original research project will be

based. Such preparations will include intensive study of the literature in the student's field of interest, instruction in the basic laboratory skills necessary for professional development in the field, and any other requirements established by the principal advisor and program director, in addition to the course requirements discussed above.

No later than 18 months after admission, the candidate shall present to his/her thesis committee an original proposal for contribution to knowledge in his/her area of specialization. It shall include an extensive review of the relevant scientific literature, a description of the technical aspects of the proposed studies, an outline of the anticipated experimental approach to the major problem of interest, and a discussion of possible results and their interpretation. The student will be expected to defend both his/her proposal and general ability to achieve professional competence before this committee.

The thesis committee shall have at least three members: the principal advisor; the program director; and, whenever possible, an individual outside the institution with national stature in the candidate's field of interest selected jointly by the candidate, principal advisor, and program director. In addition to evaluating the content of the thesis proposal, the outside member shall have a responsibility to maintain close and frequent contact with the student and principal advisor and to advise the program director concerning the progress of the academic program. Ordinarily, the thesis committee shall be constituted as soon as possible after admission of a student to the division.

Note that the thesis proposal may be submitted to the faculty prior to completion of course requirements or the preliminary examination in order to enable research activity to begin, but the student will not be formally admitted to candidacy until these are satisfactorily completed.

Candidacy

Upon successful completion of the preliminary examination and acceptance of the thesis proposal, the student shall be admitted to candidacy for the Ph.D. and shall be expected to devote fully his /her energies to the program. A minimum residency requirement of one calendar year following admission to candidacy must be met by all students unless special exceptions are granted by the program director and dean. The principal advisor shall make frequent reports to the program director concerning the student's progress, and should either faculty member or the candidate feel it appropriate, the thesis committee can be called into session to judge the student's continued participation in the graduate program, or possible alterations in the area of his or her research efforts. In addition, the student and principal advisor will be expected to consult periodically with the other committee members who may also request the program director to call formal meetings of the thesis committee.

Conflicts between the student and/or any members of the thesis committee not resolvable by the full committee may be referred to the advisory committee of the division or higher authority as specified in the policies and procedures of the Rush Graduate School and College of Health Sciences.

Thesis

The degree of doctor of philosophy is given in recognition of high attainment and ability in a particular field of scientific research as evidenced by submission of a dissertation showing power of independent investigation and forming an actual contribution to existing knowledge. Such dissertation will be submitted to the candidate's thesis committee for review and defended orally, at least three months before the degree is granted. The thesis committee will ordinarily request an evaluation of the candidate's dissertation by a scientist of national stature not affiliated with Rush University.

Acceptance of the dissertation by the thesis committee will be reviewed by the executive committee and the dean, along with the candidate's entire academic per-

formance in the Graduate School. Determination of completion of all requirements will result in the dean's recommendation that the degree be awarded at the next scheduled commencement exercise of Rush University.

Should the candidate not have submitted a dissertation three years after admission to candidacy, the thesis committeee shall be convened to evaluate the candidate's progress, and if proper to suggest alteration in the program.

General Policies of the Graduate School

This program is subject to changes required to conform to the general policies and provisions of the Graduate School adopted by the executive committee from time to time. However, major changes in policy shall not retroactively affect students already admitted to the program.

Research Areas Represented

Members of the division carry out research in three overlapping areas: (1) transport and electrical properties of membranes and complex tissues; (2) motor and sensory processing in the mammalian nervous system; and (3) circulatory phenomena.

Membrane properties. Both the transport and the excitability properties of membranes are under study.

The properties of the digitalis-receptor of the heart, a component of the Na + K pump of the cardiac muscle membrane, are being studied. One project is focused on the physiological regulation of this system by hormones. Specifically, changes in cardiac performance that accompany altered thyroid function have been shown to result from altered synthesis of (Na + K)ATPase in the cardiac muscle membrane. In a related study the autonomic nervous system was shown to regulate (Na + K)ATPase via modulation of cyclic nucleotides. Finally, a technique for the automatic, continuous assay of (Na + K)ATPase is being developed.

The basic ionic mechanism underlying the action potential is being studied in voltage-clamped giant axons. Previous investigations have shown that when examined in sufficient detail, the kinetics of sodium activation and inactivation show striking departures from the behavior expected for a system consisting of non-interacting, voltage-sensitive gates such as those implicit in the classical Hodgkin-Huxley formulation. Presently, both traditional voltage-clamp and internal perfusion techniques, and new procedures for noise analysis and measurements of intramembrane charge movements are being used to further elucidate the molecular details of the sodium and potassium channels.

Problems in synaptic physiology are divided into two classes: the method by which transmitters are released from the prejunctional element, and the nature of the biophysical interaction with the postjunctional receptor giving rise to changes in membrane permeability. Both questions are being actively investigated.

Nerve cell bodies exhibit a complexity of behavior not usually seen in the axons they support and often contain quite unique sorts of ionic channels. In order to understand such behavior, neurons from simple invertebrate nervous systems are being quantitatively examined using voltage-clamp techniques in much the same way as such procedures have been applied to the problems of nerve excitation.

Skeletal muscle fibers have a structure considerably more complex than nerve axons, including invaginations of the surface membrane that form a tubular system running almost transversely across the fiber. The structural and electrical properties of skeletal muscle fibers are being studied in some detail, and a detailed model of the electrical properties expected from the branching tubular system is being constructed by measuring such properties using methods of linear electrical circuit theory. Techniques include both sinusoidal and stochastic analysis. The theory and measurements are being extended to try to predict the shape and conduction velocity of the propagating

action potential, the natural electrical signal that initiates contraction. Attention is also being paid to the mechanism by which the action potential occurring across the membranes of the tubular system initiates contraction.

Artificial bilayer membranes may be constructed from a mixture of a surfactant and an alkane, and various transport molecules added to produce effects similar to those seen in living tissues. The physical basis of membrane transport can then be studied in a simple system of defined composition and compared with natural phenomena.

Information Processing in the Central Nervous System. The processing of visual information by the mammalian nervous system is being studied in both human and experimental human preparations. The laterality of information processing in female subjects with Turner's syndrome is being investigated through the recording of visual evoked responses in the electroencephalogram. In animal models visual processing is being studied with microelectrode techniques (extracellular action potentials and evoked population responses); of particular interest here is the effect on the visual system of such homeostatic imbalances as hyperthermia and hypoxic hypoxia.

The control of motor behavior by the nervous system is also being studied in normal human subjects. Responses to different kinds of stimulus-induced errors introduced into the performance of various motor actions are being monitored. The latencies of these responses will provide information as to the CNS level at which they are generated, and their amplitudes will provide a measure of the general level of excitability at different segmental levels. By studying different types of motor actions and using different stimuli, singly and in combinations, it will be possible to uncover information about the motor mechanisms responsible for the coordination of voluntary and involuntary (reflex) behavior.

Epileptic seizures can be induced in animals by a variety of techniques. Such animal models are being used to investigate the basic mechanisms underlying this behavior and the ways in which seizures may be prevented from developing or controlled. In addition, basic mechanisms of information processing in the mammalian visual and association cortex are being investigated with the aim of elucidating cellular correlates of learning. Invertebrates such as snails and crayfish have nervous systems in which individual cell bodies are large and easily identified from one animal to another. Electrodes may then be inserted into such cells and recordings made while the animal is exhibiting a particular response to learn more concerning the neural basis of complex behavior patterns.

Circulatory Phenomena. Three separate projects are under way in this area. The effects of pulsation on blood flow in the laminar transition region are being studied. The pulse has been found to cause an early transition to turbulent flow, an effect that is strongly dependent on pulse amplitude but only slightly affected by pulse frequency. Furthermore, the effect is inversely related to tube length, being unimportant in tubes having the same geometry as actual blood vessels. These results indicate the importance of vessel geometry in protecting the circulation against excessive energy losses from turbulence. A second project in this area involves a study of the microcirculation of skeletal muscle. Of particular interest here is the distribution of flow and the transport of materials that occurs during exercise.

Finally, the responses of the cerebral vasculature to conditions of hypoxic hypoxia are being investigated. Local blood flow, tissue oxygen levels, and neural function (visual evoked responses) are being monitored in an attempt to determine the mechanism(s) responsible for the high sensitivity of the cerebral cortex to oxygen lack. Also of interest are the occurrence and mechanism of oscillations in tissue oxygen tension recorded in some parts of the brain.

Course Offerings

The following courses will be available, subject to demand and limitation, to graduate students within the Graduate School. (For complete course descriptions, see section on course offerings, page 162.)

PHYSO 451 *Medical Physiology I*
PHYSO 452 *Medical Physiology II*
PHYSO 502 *Introductory Membrane Biophysics*
PHYSO 503 *Physiology of Striated Muscle*
PHYSO 513 *Cardiovascular Physiology*
PHYSO 514 *Functional Neurophysiology*
PHYSO 523 *Circuit Theory and Practical Design*
PHYSO 524 *Linear Differential Equations and Transform Methods*
PHYSO 525 *Linear Systems Analysis*
PHYSO 526 *Control in Physiological Systems*
PHYSO 598 *Introduction to Research*
PHYSO 640 *Applied Electrophysiology*
PHYSO 641 *Molecular Mechanisms in Control of Ion Permeability*
PHYSO 651 *Advanced Topics in Muscle Physiology*
PHYSO 652 *Active Transport Processes*
PHYSO 653 *Problems in Synaptic Physiology*
PHYSO 655 *Sensory Neurophysiology*
PHYSO 656 *Neural Correlates of Behavior*
PHYSO 699 *Thesis Research*

Affiliated Colleges

Students who seek entrance to the baccalaureate programs in nursing and medical technology at the College of Nursing and the College of Health Sciences apply directly to the affiliated colleges of their choice. Each college provides an excellent basis for the professional portion of the undergraduate programs at the Rush campus.

The participation of each affiliated college with Rush is unique. Carleton and Grinnell ask that students spend three years on their campuses before coming to Rush for the final two years. The other twelve schools require a minimum of two years academic residence. Several schools offer dual degrees—one from Rush with a major in nursing or medical technology, and one from the affiliated college in another major. Each campus specifies requirements for the second degree. Carleton participates only in the undergraduate nursing program. Currently St. Olaf only participates with Rush in an experimental program which provides one month of intersession residency at Rush for selected students from St. Olaf. During this period, students are exposed to an organized didactic and experiential program intended to inform them more fully concerning health careers.

The pre-health curriculum also varies from campus to campus because of scheduling, curricular offerings and course descriptions. For specifics about each college it is best to check with the admissions office or health careers advisor on the campus. The affiliated colleges are:

Beloit College
Carleton College
Coe College
The Colorado College
Cornell College
Fisk University
Grinnell College
Illinois Institute of Technology
Knox College
Lake Forest College
Lawrence University
Macalester College
Monmouth College
Ripon College
St. Olaf College

Although the colleges are characterized by their own styles, traditions and programs, each is noted for its academic excellence and liberal arts tradition. The choice of where students spend the first years of undergraduate study is their decision. They may choose any one of the 14 affiliated colleges. Each is a port of entry to the baccalaureate programs of Rush University. The following brief descriptions of each of the colleges will help students make informed decisions.

Beloit College

Beloit, WI 53511
(608) 365-3391 ext. 244

Enrollment 1979-80
Total: 1,030
Men: 520
Women: 485

Calendar
Semester Plan

Admissions
Required
S.A.T. or A.C.T.

Admissions Interview
Strongly encouraged,
but not required

Costs 1980-81
Total: $6,930
Tuition: $5,070
Room and Board: $1,750
Fees: $110

Beloit College has been a strong liberal arts college since 1846, two years before Wisconsin became a state. It has maintained a tradition of academic excellence in both the sciences and the humanities.

The student-faculty ratio is 12 to 1; therefore, classes are generally small. All the science faculty hold Ph.D.'s, and department chairmen teach both introductory and advanced courses. The Science Center consists of Chamberlain Hall, a five-story laboratory-classroom building; Mayer Hall, an auditorium building; Kohler Science Library; and Pierpont Wood Conservatory (Greenhouse). Special facilities include the Thompson Observatory with a 22-inch Celestron telescope, a particle accelerator designed and built by students and faculty, and individual research laboratories for students pursuing undergraduate research. An off-campus area, Chamberlain Springs, is used for field work in the sciences.

In addition to using traditional classroom approaches, members of the science faculty have introduced laboratory sessions that allow students to investigate new problems in a real-life manner, collecting data to provide answers to those problems. Background courses are available in chemistry and mathematics for entering students who have insufficient preparation in those areas.

The college is located on a 65-acre oak and hickory studded campus in a community of 36,000 on the Wisconsin-Illinois border, surrounded by farmland and recreational areas. Beloit is 100 miles from Chicago, 75 miles from Milwaukee and 50 miles from Madison. Students from all over the United States and several foreign countries come to Beloit College for an education that produces a distinctive graduate.

Carleton College

Northfield, MN 55057
(507) 645-4431 ext. 511

Enrollment 1979-80
Total: 1,832
Men: 953
Women: 879

Calendar
3-3 Plan

Admissions Tests
Required
A.C.T. or S.A.T.

Admissions Tests
Recommended
S.A.T. English Comp.
achievement test, and
2 other achievement tests

Admissions Interview
Recommended

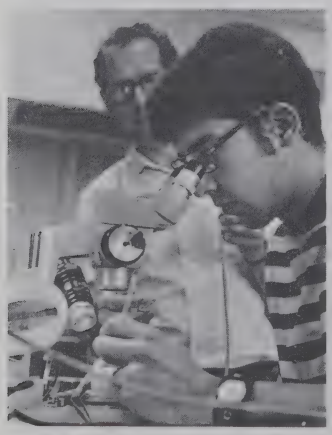
Costs 1980-81
Total: $6,127
Tuition and Fees: $4,375
Room and Board: $1,800

The definition of a Carleton education has over 1800 variations, as is evident in the broad selection of majors chosen by its some 1800 students, either from conventional fields of interest or planned on an individualized basis.

Diversity and individuality both in the student body and in academic programs are an integral part of the college's purpose. Just as no two entering students are alike, no two Carleton graduates fit into a particular mold. They all, however, have been exposed to a range of liberal arts disciplines and have learned to question dogma, value the scientific method, and sensitivity and humanely make ethical decisions.

Carleton's 90-acre main campus, site of its fine science complex, music and drama center, library, and Lyman Lakes, is surrounded by nearly 900 acres of natural woodland and prairie that is utilized as an educational resource, as well as a recreation area.

Located in the southeastern Minnesota community of Northfield, a city of 10,000, Carleton is 40 miles south of Minneapolis and St. Paul and easily accessible by public transportation.



Coe College

Cedar Rapids, IA 52402
(319) 398-8500
(from Iowa
1-800-332-8404)

Enrollment 1979-80
Total: 1,320
Men: 649
Women: 671

Calendar
4-1-4 Plan

Admissions Tests
Required
S.A.T. or A.C.T.

Admissions Interview
Encouraged, but not
required

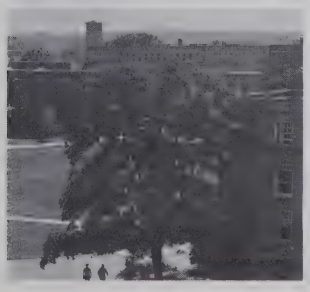
Costs 1980-81
Total: $5,470
Tuition and Fees: $3,970
Room and Board: $1,500

At Coe, through the "open choice" curriculum, students are responsible for making their college experience a meaningful one. A student has the freedom to choose from any of Coe's departmental offerings and build a varied and challenging individual curriculum along with the courses needed for completion of a major. Education does not end in the classroom, however. Students may elect a single term or academic year for studying in one of the 50 foreign and domestic off-campus programs; or, for testing career possibilities, students may participate in a work/service project or work internship.

At Coe, there are students from 36 states and 22 foreign countries. The college is situated in the urban/residential area of Cedar Rapids, a growing progressive metropolis in eastern Iowa with a population of 135,000.

Degrees offered include bachelor of arts, bachelor of music, and bachelor of science in nursing, from the 30 departmental and interdepartmental concentrations. Many students who are interested in pursuing a medical or health profession will utilize the interdepartmental general science curriculum. Coe provides modern and elaborate facilities and full use of its quality equipment for its science students. Coe is accredited by the North Central Association of Colleges and Schools, the American Chemical Society, National Association of Schools of Music, and the Iowa State Department of Public Instruction.

Coe has an interesting faculty, of whom 80 percent have received their Ph.D.'s or terminal degrees and all of whom are strongly committed to their roles as teachers. The 14 to 1 student/teacher ratio permits small and intimate classes and individual attention for the students. Coe maintains the philosophy that intellectual and emotional growth is best nurtured in an environment that is stimulating academically and supportive socially. Coe believes that a liberal arts education best prepares the individual for the future by developing aptitudes for rational and critical thought, adequate self-expression, and perceptive associations with other human beings. Education should be a part of the growth process and Coe would like to have a part in that process.



The Colorado College

Colorado Springs,
CO 80903
(303) 473-2233
ext. 219, 220

Enrollment 1979-80
Total: 1,927
Men: 969
Women: 958

Calendar
Block Plan

Admissions Tests
Required
S.A.T. or A.C.T.

Admissions Interview
Not required

Costs 1980-81
Total: $6,400
Tuition and Fees: $4,700
Room and Board: $1,700

Colorado College is an independent, coeducational, liberal arts college. It occupies a 79-acre campus in Colorado Springs, a city of 200,000 in a metropolitan area of more than 320,000. It is located at a point where the high western plains meet the Rocky Mountains. The surrounding area offers a natural laboratory for many disciplines, as well as a variety of recreational activities.

The Colorado College Plan, started in 1970, is an exciting departure from the traditional academic calendar. Under the plan, the year is divided into nine three-and-one-half-week "blocks." Four-and-one-half-day block breaks between courses allow students time for non-academic pursuits. Most courses are completed in one block and a student takes only one course per block.

The block plan, as it is commonly known, has many advantages. It has reduced class size to an average of 15 students. It allows freedom in scheduling classes so that an astronomy class might meet at midnight, or a biology class can go into the field for a week. It also allows the college to attract distinguished visiting professors with ease, and it has contributed to greater involvement in the educational process on the part of the students.

Cornell College

Mt. Vernon, IA 52314
(319) 895-8149

Enrollment 1979-80	Admission Tests
Total: 907	Required:
Men: 475	S.A.T. or A.C.T.
Women: 432	Admissions Interview:
	Recommended
	Calendar
One-Course-at-a-Time	Costs 1980-81
(September-May)	Total: $6,050
	Tuition & Fees: $4,450
	Room and Board: $1,600

Cornell has a 128-year tradition of academic excellence, and a reputation, for which our science programs have been largely responsible, to match.

Nearly 70 percent of Cornell's science majors in the last 16 years have entered graduate programs in health careers or the physical sciences. In the past four years, Cornell has earned a 70 percent success rate in medical school placements.

The Cornell One-Course-At-A-Time plan provides an efficient result-oriented approach to scientific studies. Students take one course at a time; classes last three and one-half weeks, followed by a four-day weekend. Instead of four courses competing for your time and best effort, you concentrate on one course at a time. Free from the tug-of-war of other courses, you're free to do your best in each course.

And since you take one course each term, there's flexibility beyond the old bind of specific classrooms and time slots. Labs may be scheduled to illustrate course material as you cover it. You may find yourself "in class" at a biology field station, a commercial laboratory, clinic, or hospital.

Cornell's position in the vanguard of undergraduate science education was bolstered recently by the addition of the $2 million West Center for Biology and Chemistry, which provides Cornell students with state-of-the-art laboratory, classroom, and library facilities.

But the strength of the sciences at Cornell lies in a talented and dedicated teaching faculty, all of whom hold doctorates from leading institutions. And although teaching is their highest priority, the faculty are well represented in the research and publishing fields and apply themselves to Cornell and ACM off-campus programs as well.

Gerard Piel, publisher of Scientific American, visited Cornell in 1975 and wrote, "Its science faculty is first rank . . . Their teaching proceeds from research . . . but their professors put a lot more time and heart and brains into their teaching than the distinguished professors at our great 'research' universities."

Fisk University

Nashville, TN 37203
(615) 329-8665

Enrollment 1979-80
Total: 1,101
Men: 391
Women: 710

Calendar
Semester

Admissions Tests
Recommended
S.A.T. or A.C.T.

Admissions Interview
not required

Costs 1980-81
Total: $5,985
Tuition and Fees: $4,050
Room and Board: $1,935

Fisk University is a private institution whose main purpose is to provide undergraduate education of excellence. Through a well-planned program involving both undergraduate and graduate education, the University aims to develop among its students a broad understanding of the basic principles and values in the humanities and fine arts, the natural sciences and mathematics, and the social sciences. The ultimate goal is to equip each student for intellectual and social leadership in the modern world.

Learning at Fisk University is a dynamic living experience. The university presents numerous socially-oriented programs through an interdisciplinary approach to higher education. At Fisk, black studies become part of a balanced intracurricular program.

Fisk is located on a 40-acre campus near the downtown area of Nashville, Tennessee. It offers programs leading to the B.A. and M.A. degrees in 19 major areas of study.

The traditional excellence of Fisk's programs and its students is evidenced by the fact that in 1930, Fisk became the first black college to receive full accreditation by the Southern Association of Colleges and Schools. In 1952, the school established a chapter of the Phi Beta Kappa Honor Society. In 1975, Fisk became the first predominantly black institution to have a national chapter of Mortar Board. Other national academic societies, as well as major black national sororities and fraternities, have chapters on the Fisk campus.

For sports enthusiasts, complete outdoor sports and recreation facilities, including athletic fields and tennis courts, are available. A municipal golf course is nearby. Fisk students have the opportunity to participate regularly in intercollegiate sports competition.

Grinnell College

Grinnell, IA 50112
(515) 236-4848

Enrollment 1979-80
Total: 1,232
Men: 698
Women: 534

Calendar
Semester Plan

Admissions Tests
Recommended
S.A.T. or A.C.T.

Admissions Interview
not required

Costs 1980-81
Total: $6,765
Tuition and Fees: $5,285
Room and Board: $1,480

Grinnell is a private, coeducational, liberal arts college that enrolls students from all parts of the United States and from many foreign countries. Life on the Grinnell campus is informal and individualistic.

Grinnell stresses an integration of private and public responsibility: the first with its attributes of self-knowledge, self-reliance, and intellectual discipline; the second with its qualities of social conscience and concern for public welfare.

Grinnell offers courses of study in the humanities, sciences, social studies, elementary and secondary education, physical education, and other programs. A faculty-student ratio of 1 to 11 permits ample opportunity for independent study, including the Freshman Tutorial Program, guided reading, special projects, and advanced group study.

The attractively landscaped 90-acre campus in a small south-central Iowa City has 35 buildings, including residence halls. Among recreational facilities is the large, multiple-use physical–education complex.

Illinois Institute of Technology

Chicago, Illinois 60616
(312) 567-3025

Enrollment 1979-80
Total: 7,244
Men: 5,910
Women: 1,334

Calendar
Semester Plan

Admissions Tests
Required
S.A.T. or A.C.T.

Admissions Interview
Recommended

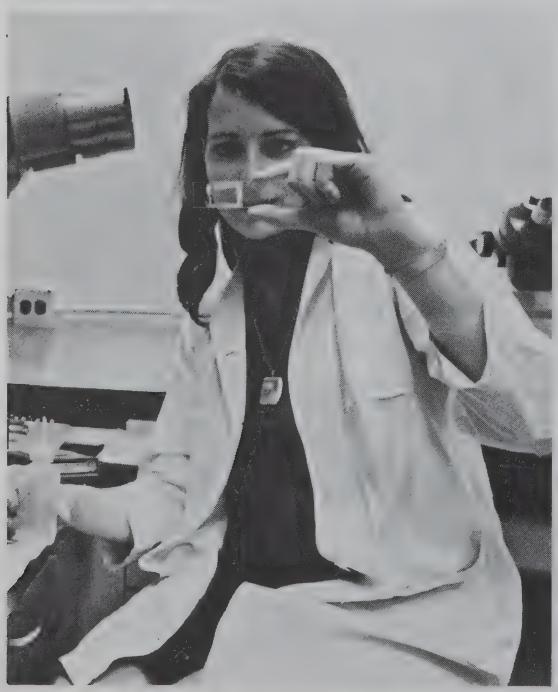
Costs 1980-81
Total: $6,340
Tuition: $4,290
Room and Board: $2,050

Illinois Institute of Technology is a medium-sized, private, coeducational university emphasizing preparation for professional careers in the sciences, engineering, the social and behavioral sciences, the humanities, architecture, planning, design, management, finance, and law. It offers undergraduate and graduate degree programs through six schools and colleges on both a full-time and part-time basis. In addition, excellent pre-professional programs are available to prepare students for postgraduate study in medicine, dentistry and law.

Because of IIT's scope and flexibility, students have the opportunity to investigate a broad range of disciplines, pursue specialized programs in non-traditional areas such as biomedical engineering and, with approval, to design individualized programs. In all areas, including biology, chemistry and physics, IIT excels on the undergraduate, graduate, and research levels.

The 120-acre IIT Center is located on the near south side of Chicago, approximately three miles from Rush University. Facilities include the IIT Research Institute of Gas Technology, the John Crerar Library (1,300,000 volumes), a shopping center, service station, gymnasium and recreation area, six dormitories, nine resident fraternity houses, and the student union.

Applications are welcome from all students who are earnestly interested in an education that prepares them for professional practice.



Knox College

Galesburg, IL 61401
(309) 343-0112

Enrollment 1979-80
Total: 1,020
Men: 550
Women: 470

Calendar
3-3-3 Plan
December Mini-term

Admissions Test
Required
S.A.T. or A.C.T.

Admissions Interview
Strongly recommended

Costs 1980-81
Total $6,744
Tuition and Fees: $4,924
Room and Board: $1,820

Knox College, founded in 1837, has for 142 years been dedicated to providing quality education for its students. The college occupies a 60-acre campus located two blocks from downtown Galesburg, a city of approximately 38,000.

The Knox year is divided into three ten-week sessions and one four-week session, the latter, an optional mini-term occurring between Thanksgiving and Christmas. During the mini-term, students are free to find work or to continue their studies.

In addition to the 2-2 Plan (two years at a liberal arts college, two years at Rush), Knox has a 3-2 Plan, under which, upon completion of the program, students may earn a bachelor of arts degree from Knox and a bachelor of science degree from Rush.

Of the freshmen enrolled at Knox during 1978-79, 75 per cent ranked in the upper 20 per cent of their high school graduating classes. Of faculty members teaching in the 19 areas of study offering a major, 86 per cent hold the Ph.D. degree. The student-faculty ratio at Knox is 11 to 1.

Knox-Rush students have something to say about their experience in the program.

Lisa Arthur, (nursing) from Glencoe, Illinois: "I am planning to graduate from Knox College with a biology and Spanish major. Last year I studied in Barcelona, Spain, with Knox's program for junior year abroad."

Pam Wetterauer, (medical technology) from Downers Grove, Illinois: "I combined mathematics and computer science with my chemistry major which will allow me to work with hospital and/or laboratory computers and instruments."

Henry Houser, Professor of Sociology, counsels all students interested in the programs. Dr. Houser's responsibility is indicative of the concern of the college for the success of the programs.

Lake Forest College

Lake Forest, IL 60045
(312) 234-3100 ext. 200

Enrollment 1979-80
Total: 1,000
Men: 489
Women: 511

Calendar
4-4 Plan

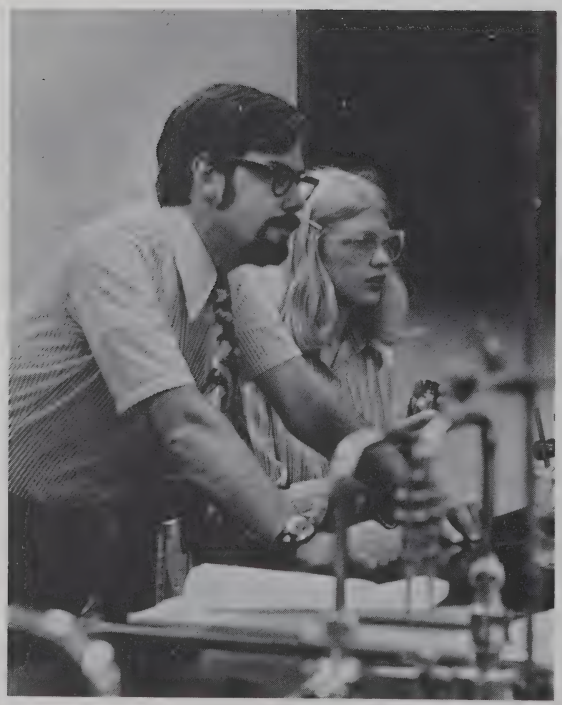
Admissions Tests
Required
S.A.T. or A.C.T.

Admissions Interview
Encouraged, but not required

Costs 1980-81
Total: $7,130
Tuition and Fees: $5,305
Room and Board: $1,850

Lake Forest College is committed to the development of creative individuals who will live lives of leadership and service. The college has chosen to be a small community where close personal relationships exist among 87 full-time faculty and 1,046 students. More than 80 percent of the faculty hold the Ph.D. degree. The college maintains a faculty-student ratio of approximately 1 to 12. The diverse student body represents 40 states and 19 foreign countries.

Founded in 1857, Lake Forest College is located on 107 wooded acres in the residential community of Lake Forest, less than a mile from Lake Michigan and 20 miles north of Chicago. The location of the college in the Chicago metropolitan area means that internships and field research projects are important elements of the academic program.



Lawrence University

P.O. Box 599
Appleton, WI 54912
(414) 739-3681 ext. 232

Enrollment 1979-80
Total: 1,158
Men: 592
Women: 566

Calendar
Three terms,
ten weeks each

Admissions Tests
Required
S.A.T. or A.C.T.

Admissions Interview
Encouraged, but not
required

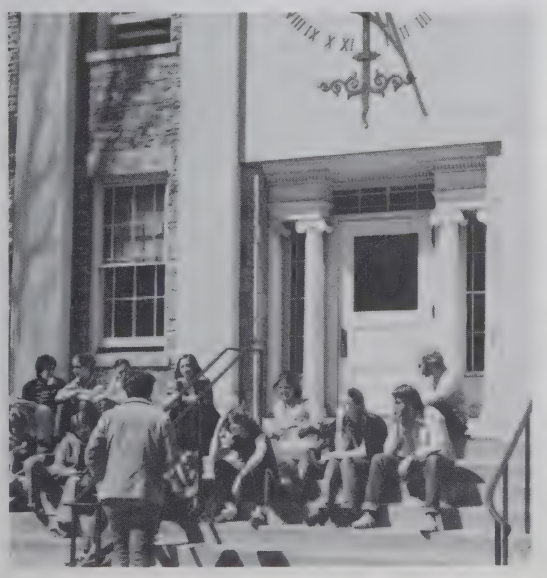
Costs 1980-81
Total: $6,825
Tuition: $5,256
Room and Board: $1,569

Lawrence University, founded in 1847, is considered unique because it combines the following qualities: a reputation for excellence in education, students who are treated as adults and who learn to use their minds well, a sound preparation for careers and graduate schools, a superior location that affords cultural opportunities and year-round recreational advantages, an attractive, vital campus-life program, a wealth of off-campus options, strong curriculum in both the college and the university's conservatory of music, diversity of ideas and people, and affordability.

Lawrence's extensive science and computer facilities provide a wealth of hands-on experience. An outstanding new feature of the excellent science curriculum is the Bahamas Marine Term conducted jointly by the biology and geology departments. Other academic advantages include one of the few small-college classics departments in the country, the oldest theatre-drama department in a liberal arts college, and private painting studios for art students. Since 1874 the university's conservatory has been preparing students for music careers, and it provides Lawrence with cultural activities not available at most colleges.

The strong programs in the humanities, physical and social sciences are staffed by a superior faculty—95 percent of the university's professors, associate professors, and assistant professors hold the Ph.D. or highest degree in their field. A student-faculty ratio of 11 to 1 in the university's 22 academic departments assures individual attention, and students are encouraged to design their own programs of study. Lawrence offers several interdisciplinary areas of study, two of the newest being in public policy analysis and in environmental studies.

Lawrence is expensive, but it has a commitment to financial aid that allows it to say: In the past 16 years, every admitted student has received aid equal to his or her full demonstrated need.



Macalester College

St. Paul, MN 55105
(612) 647-6357

Enrollment 1979-80
Total: 1,783
Men: 887
Women: 896

Calendar
4-1-4 Plan

Admissions Tests
Required
S.A.T. or A.C.T.

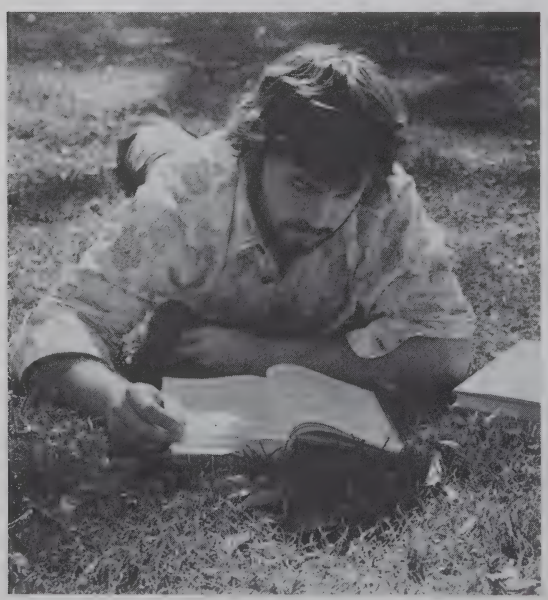
Admissions Interview
Recommended

Costs 1980-81
Total: $6,525
Tuition: $4,725
Room and Board: $1,800

Macalester is a privately-supported, four-year liberal arts college known for its commitment to high academic standards. Founded in 1874, it offers students an uncommon array of educational and personal opportunities. Today, students choose from 33 majors as well as individually designed and interdisciplinary majors. They also take advantage of the College's location in a thriving, metropolitan area. The College's Community Involvement Program, for example, gives students the chance to gain practical, career-oriented experience each semester by interning and volunteering in over 300 business firms, service agencies, government centers and cultural facilities.

Macalester's international program, one of the most extensive of any small college in the nation, enables 200 students a year to study abroad and offers a variety of majors in international affairs and related programs. Students also benefit from a diverse and dynamic community which includes 1,783 scholars from 48 states, the District of Columbia, Puerto Rico and 39 foreign countries. Challenging each other to heights of excellence, Macalester students since 1971 have earned 25 Fulbright-Hays Scholarships, five Danforth Fellowships and two Rhodes Scholarships.

The 120 faculty members at Macalester, 82 percent of whom have Ph.D.'s, have published over 50 books and countless scholarly articles in professional journals over the past five years. During that time, they also received over a million dollars in grants to find new and better ways to teach. And many Macalester faculty members have earned national recognition for their scholarly achievements and for their excellence in classroom instruction.



Monmouth College

Monmouth, IL 61462
(309) 457-2131

Enrollment 1979-80
Total: 700
Men: 400
Women: 300

Calendar
3-3 Plan

Admissions Tests
Required
A.C.T. or S.A.T.

Admissions Interview
Recommended

Costs 1980-81
Total: $5,760
Tuition: $3,930
Room and Board: $1,830

At Monmouth, our greatest effort is teaching students well and providing the opportunity for each student to achieve the maximum individual growth of which he or she is capable — academically, socially, spiritually, morally, and physically. The college seeks for admission those students who can both profit from and contribute to the total educational programs of the college.

A Monmouth education is an individual experience, its breadth and depth determined only by the desire of students to learn from a wide range of major fields of study, independent study programs, work experience, volunteer programs, and a broad array of social and cultural activities. We believe that a liberal arts education is a viable link to the future for our students. The college strengthens this link through small classes, frequent student-faculty interaction, independent and interdisciplinary study, advanced placement, honor programs, and opportunities for special work.

With the recently erected Haldeman-Thiessen Science Center and a natural sciences and mathematics division in which every professor holds the Ph.D., Monmouth's programs in these areas are outstanding.

The Monmouth curriculum allows students to choose from four different types of majors, and students may tailor a plan of study to fit their own particular needs. As well, advanced placement, credit by examination, and other options allow well-qualified students to accelerate the normal four-year program of three terms per year, three courses per term. Monmouth's residential campus of 700 students and 65 faculty makes the student-faculty ratio 11 to 1. Monmouth College was founded in 1853 and is related to the United Presbyterian Church.

Ripon College

Ripon WI 54971
(414) 748-8102

Enrollment 1979-80
Total: 930
Men: 520
Women: 410

Calendar
Semester Plan

Admissions Tests
Required
S.A.T. or A.C.T.

Admissions Interview
Recommended

Costs 1980-81
Total: $6,300
Tuition and Fees: $4,765
Room and Board: $1,545

Ripon, an independent coeducational college of the liberal arts and sciences, founded in 1851, has retained the thoroughly tested principles of liberal education while developing innovations that make learning enjoyable, challenging, and rewarding. For well over a century, Ripon graduates have gone on to satisfying and responsible careers in virtually every profession and vocation.

Ripon students come from 44 states and 18 foreign countries, and from diverse social, ethnic, racial, and religious origins. Faculty members — 80 percent of whom hold the Ph.D. — are more committed to teaching and advising than other scholarly or professional activities. Since all faculty members teach both introductory and advanced courses, and since the student-faculty ratio is only 12 to 1, students have the opportunity to work closely with outstanding teachers from the beginning of their college careers. More than 70 percent of the classes have fewer than 20 students.

Ripon also offers a full complement of extra-curricular activities and counseling services. Thus, a Ripon education can embrace all aspects of a young person's development.

St. Olaf College

Northfield, Minn. 55057
(507) 663-2222

Enrollment 1979-80
Total: 3,024
Men: 1,463
Women: 1,561

Calendar
4-1-4

Admissions Tests
Required
S.A.T. or A.C.T. or
P.S.A.T.

Admissions Interview
Encouraged

Costs 1980-81
Comprehensive Fee:
$5,700

Innovative education has been a hallmark of St. Olaf College in Northfield, Minn., since its founding by Norwegian Lutheran immigrant pioneers in 1874.

The 350-acre, wooded campus is located on the western edge of Northfield, 40 miles south of the Twin Cities of Minneapolis and St. Paul.

St. Olaf was one of the first colleges to institute the 4-1-4 curriculum calendar. Multidisciplinary course work is expanding each year beyond the 47 majors offered for a bachelor of arts degree. The college also confers bachelor of music and bachelor of science in nursing degrees.

The Paracollege provides individualized studies and innovative learning programs for students who prefer an alternate route to the B.A. degree.

Term abroad, global semester, and interim abroad programs provide opportunities for study in 15 countries with emphasis on Asian and Third World cultures. More than half of St. Olaf students study abroad before they graduate.

St. Olaf is a college of The American Lutheran Church. A chapter of Phi Beta Kappa was established in 1949, and an honor system has continued in effect at St.Olaf since 1911.

Course Descriptions

Course Abbreviations

Courses listed and described in this section are Rush University courses expected to be offered by faculty of the College of Health Sciences for the 1980-81 academic year, and do not represent a complete catalog of Rush University courses.

Rush University courses are listed alphabetically according to the *discipline* to which the course content is most closely related. These disciplines do not necessarily reflect a *department* in the university or in the Medical Center.

Course Numbers

A three-digit course number follows the course abbreviation. Courses numbered 300-399 are third level courses; courses numbered 400-499 are fourth-year level courses; courses numbered 450-499 are dual level and may be taken for undergraduate or graduate credit; courses numbered 500-599 are graduate level; 600 represents the doctoral level.

Course Content

The course title is followed by a brief description of course content. Following each description is a series of entries, enclosed in brackets [ ], giving the following information for each course:

Information	Entry
Prerequisite	Prerequisite course abbreviations and numbers.
Instructor	Specific instructor's name or staff.
Quarter in which course is given	W(inter), Sp(ring), S(ummer) or F(all), if course is given once a year: or Alt W, Alt Sp, Alt S or Alt F, if course is given every other year; or X, if course is not regularly given, it may be offered: "By special arrangement, with instructor's permission"; or R, if course is not regularly given, it may be offered: "As registration permits".
Course content	Each series of entries includes three hyphenated numbers in parentheses, *e.g.* (2-3-3). The first number refers to hours per week in the classroom or seminar; the second, the number of hours per week in laboratory or clinical setting; the third, to quarter hours of credit. If any of these numbers is variable, it is replaced with a "v".

Independent Study Courses

Students may enroll in an independent study course in any discipline of the university under the direction of the appropriate faculty member with his or her written permission, and the approval of the Office of the Dean.

The course numbers 441 and 591 will be used for *Independent Clinical Study*, with the appropriate discipline prefix.

The course number 449 will be used for academic *Independent Study* for undergraduates and 599 for *Independent Readings* for graduate students, with the appropriate discipline prefix.

Introduction of New Courses

Upon approval of the faculty, new courses not listed in the catalog may be listed as *Special Topics* under the appropriate discipline prefix and the numbers 300, 400 or 500 to indicate the level of offering. The topic covered will be listed on the student's academic record.

Anatomy

ANAT 451
Neuroanatomy. The morphological organization of the central nervous system is explored through lectures, preceptorials, laboratory dissection, and microscopic examination of human brains and spinal cord. Taught as part of NEURO 451 (Rush Medical College). [Staff, Sp, (3-4-4)]

ANAT 455, 456
Histology. An introduction to the use of the microscope. The microscopic anatomy of cells, tissues, and organ systems of the human body is studied through laboratories, lectures, and preceptorials. Special attention is given to the fine structural anatomy of cell organelles and individual specializations revealed by the electron microscope. Functional and clinical correlations are emphasized. [Schmidt, F, W, (2-4-4)]

ANAT 462
Introduction to Neurobiology. The development, morphology, and functional significance of the human nervous system is presented in lecture and by demonstrations. Fixed human brain preparations and series of neurological slides are used as visual aid materials. [Maibenco, Schmidt, F, (2-4-4)]

ANAT 471
Human Anatomy I. The structure and function of the human body are examined topographically through laboratory dissection, lectures, and preceptorials. Laboratory dissection is conducted regionally, encompassing the thorax, abdomen, pelvis, perineum, head and neck, back, and extremities. Radiological anatomy, living anatomy, and clinical correlations are emphasized.

Embryology: The fundamentals of human development are examined from gametogenesis and fertilization through the formation and differentiation of the germ layers, organogenesis, and morphogenesis of the fetus. Congenital malformations and experimental embryology are introduced where feasible. [Schmidt, F, (4-6-8)]

ANAT 472
Human Anatomy II. The structure and function of the human body are examined topographically through laboratory dissection, lectures, and preceptorials. Embryology is introduced where pertinent. Continuation of ANAT 471. [Schmidt, W, (4-6-8)]

ANAT 511
Comparative Cytology of Tissues. Cellular structure will be studied in relation to the organization of selected tissues. Emphasis includes application of special techniques, and the evolution of contemporary views on structure and function. [Prerequisite: ANAT 455, 456, Colgan and Hughes, Sp, (3-0-3)]

ANAT 513
Anatomy of the Eye. The histology and embryology of the eye will be reviewed in detail as the basis for discussion of selected topics. These will include congenital malformations, physiology, and pharmacology of selected ocular systems; vessels and nerves of the orbit; and regional structure and function. [Hughes, Sp, S, X, (4-0-4)]

ANAT 521
Experimental Morphogenesis. Problems related to normal growth and especially the genesis of complex form will be explored in detail. The class will initially entertain basic concepts in growth regulation. Students will then prepare, present, and analyze current publications on specific morphogenetic problems. Independent research projects will be encouraged where feasible. [Prerequisite: ANAT 471-2, 455-6, Dinsmore, Schmidt, Alt Sp, (3-v-4)]

ANAT 522
Tissue Repair and Mechanisms. The variable ability of mammalian and non-mammalian tissues to repair and to reconstitute themselves will be considered. Original papers on cellular determination, differentiation, cell turnover, and other select topics will form the nucleus of seminar discussions. [Prerequisite: ANAT 455-6 or permission of instructor, Dinsmore, Schmidt, Alt Sp (3-0-3)]

ANAT 523
Cell Biology of Vertebrate Repair and Regeneration. Analysis of cytoarchitectural concepts of amphibian appendage regeneration correlated with molecular basis of specific tissue responses to trauma examined principally from histochemical-cytochemical data. This, in turn, will be correlated with tissue repair mechanisms common to all vertebrates. Lectures, preceptorials, and laboratory. [Dinsmore, Schmidt, Sp, S, R, (3-v-3)]

ANAT 524
Morphologic and Physiologic Adaptations in Development, Maturity, Aging, and Injury. Analysis of biologic structure and function during vertebrate growth and development and the response of these factors to aging and trauma. [Maibenco, W, Sp, R, (3-2-4)]

ANAT 541
Topics in Muscle Biology. A seminar format will be employed for critical examination of papers relating to the biology of muscle in one of two areas: 1) current topics in excitation-contraction coupling, contractility, and energetics; or 2) review of the neuromuscular junction followed by examination of experimental systems dealing with the trophic maintenance and the development of muscle fiber types. Contributions of nerve injury to the pathogensis of muscle disease will be considered. [Prerequisite: Inst. Perm., Colgan and Hughes, F, (3-0-3)]

ANAT 560
Topics in Neurobiology. A seminar format will be utilized to review selected topics and original papers within one of the following units of study: neurogenesis, synaptic organization of neural systems, or current methods in neuroanatomy research. [Durica, Hughes, Sp, R, (4-0-4)]

ANAT 581
Approaches and Methods in Morphologic Research. Study of how sources of information, methods of investigation, and technical procedures are applied to anatomic research. Demonstrations of techniques and student laboratory participation is included. [Staff, S, (2-4-4)]

ANAT 591
Preceptorials in Anatomy. Laboratory experience is provided in conjunction with related preceptorials on selected topics in the anatomical sciences. [Prerequisites: ANAT 451-2, 455-6, 471-2, Staff, S, (2-4-4)]

ANAT 592
Concepts in Morphology. Seminars and tutorials offered by faculty and guests on topics of special interests in the morphological sciences. [Staff, F, W, Sp, S, X, (v-v-v)]

ANAT 601
Surgical Anatomy. A laboratory program of regional dissections and demonstrations. The applied, clinical, and surgical aspects of anatomical regions is emphasized. [Prerequisites: ANAT 471-2 or equivalent, Doolas, F, W, Sp, S, X, (0-v-v)]

ANAT 602
Advanced Anatomy. A laboratory program of special dissections and demonstrations on selected regions of the body—thorax, abdomen, pelvis and perineum, upper and lower extremities, and the central nervous system (spinal cord and brain). [Prerequisites: ANAT 455-6, 471-2, 452 or equivalent, Schmidt, F, W, Sp, S, X, (0-v-v)]

ANAT 699
Research. Research devoted to the preparation of a thesis in partial fulfillment of the requirements of the degree program. [Staff, F, W, Sp, S (0-v-v)]

Behavioral Science

BEHAV 451
Fundamentals of Behavior. Course provides the student with the basic conceptual framework and terminology used to describe and explain human behavior. It is divided into three sections: biological, psychological, and sociocultural. Primary emphasis throughout is upon the ways such various types of influences interact with health care delivery. It is designed as a series with BEHAV 453. [Staff, F, (2-0-2)]

BEHAV 452
Observation and Communication. Introduction to the interview technique and process. The interview is studied as a tool that facilitates the doctor-patient relationship and produces reliable and valid medical information. Course covers interview theory, determinants of patient behavior, and practice of interview skills. Weekly seminars utilize video tapes. [Prerequisites: BEHAV 451, 453, 473, 511, Staff, W, S, (2-0-2)]

BEHAV 453
Behavior in the Life Cycle. Introduction to a clinically based study of the individual life cycle. Emphasis is on the biological, psychological, and sociocultural factors of adaptation during each phase of the life cycle. Lecture and discussion. [Prerequisite: BEHAV 451, Staff, W, (2-0-2)]

BEHAV 461
Death and Dying Seminar I. An examination of the fears and feelings elicited by the clinical experience of contact with the dying patient, and of the fears and feelings of the critically ill patient and how to deal realistically with these fears in a clinical setting. Includes supervised patient contact. Permission of instructor. [Hovde, F, W, S, (2-0-2)]

BEHAV 462
Death and Dying Seminar II. Continuation of BEHAV 461. Individual conferences with advanced students on problems raised in their clinical experiences. [Hovde, F, W, S, (1-3-2)]

BEHAV 501
Behavioral Dynamics. Selected topics provide the basic concepts of intra- and interpersonal behavioral dynamics. The course is designed to aid the clinical specialist or nurse practitioner in understanding the emotional needs of psychiatric patient populations and to guide staff intervention in meeting these needs. Topics include developmental changes with age; socialization and resocialization; personal adjustment mechanisms in stress, conflict, and anxiety; group dynamics and leadership. [Staff, F, S, (4-0-4)]

BEHAV 511
Behavioral Deviations. Course serves as an introduction to psychopathology relevant to almost all types of medical practice but of special importance as preparation for psychiatry. General contexts are behavior, psychiatric syndromes, intervention modalities, and research. [Prerequisites: BEHAV 451, 453, 473, Staff, F, (2-0-2)]

BEHAV 473
Mini-Course Matrix. A matrix of special topic seminars is presented allowing a concentrated introduction to a significant area of behavioral study. BEHAV 473 is offered in spring. The following topics were presented in 1980. Topics may be added or deleted in subsequent years. (10 hours each unless specified.)

Adolescent Pregnancy. The purpose of this course is to help the student develop a knowledge base regarding cultural, socioeconomic, emotional, and psychological aspects of adolescent pregnancy. The course format will include seminar, lecture, and discussion on topics such as 1) the instance and prevalence of adolescent pregnancies and implications for the health provider, 2) the influence of value systems and stereotyped thinking in relation to adolescence, 3) the pregnant adolescent, 4) prevention and anticipatory guidance, abortion, and family planning, and 5) the role of the family of the pregnant adolescent.

Becoming a Physician. This course will present an opportunity to examine the process of becoming a physician. Topics to be covered include socialization into the profession of medicine, the personality and adjustment of the medical student, adaptation to medical training, styles of responding to the medical environment, first encounters with chronic disease and death, and the medical student's personal and family life including marriage, recreation, coping with stress, etc. The course is both didactic and experiential and students will be called upon to contribute from their own perspective and experience.

Behavior Genetics of Intelligence and Intellectual Dysfunction. This course consists of an introduction to behavior genetic theory and method. It will review the current status of knowledge concerning the normal distribution of intelligence, and degrees and types of mental subnormality and dysfunction. Implications for medical practice will be reviewed and discussed.

Behavioral Pediatrics and Family Practice. This course focuses on typical behavioral problems of the pre-school (2-4) and early school age (5-8) child that are seen by the pediatricians and family practitioners. It is designed to assist in the understanding and treatment of areas such as enuresis and encopresis; feeding difficulties; discipline; reactions to separations (hospitalizations, day care); and school-related difficulties.

Clinical Hypnosis. This is an introduction to clinical hypnosis. It covers the nature of hypnosis, indications and precautions for its use, integrating this modality into clinical practice, more indepth presentation of selected uses, and techniques and skills for clinical application. The format of the class will include lecture, discussion, case presentation, demonstrations, and supervised practice. Following the completion of the course, some students may be ready to use this modality under close supervision.

Clinical Studies of Suicide. This course places suicide in a social and clinical perspective and covers a range of theories of the etiology of suicidal behavior from literature, the social sciences, clinical psychology, and psychiatry.

Perspectives in Community Health. This is a seminar of special topics in the field of community mental health, designed to offer students a basic understanding of the professional practitioner's role in community mental health. Emphasis will be on the ways in which theoretical orientations, conceptual issues, and ideas are translated into practical approaches relative to service delivery.

Women as Doctors; Women as Patients. This course introduces the student to some of the special issues involving women and health care. Professional and personal issues of the female physician are explored from psychological, sociological, and economic perspectives.

Behavioral Change Strategies in Medical Practice. Focusing on the doctor-patient relationship, this course considers the psychological tools a physician has available for successful behavior change in patients. Topics to be covered include a model for behavior change, intervention techniques, and patient compliance with prescribed regimens. Use of behavior change strategies with cigarette smokers and men with elevated serum cholesterol will be used as examples.

The Changing Health Care Delivery Team. The utility of various models for organizing the talent of members of the health care delivery team will be contrasted in light of changes in hospital organization, new political and economic demands, and the emergence of new types of clinicians.

Obesity. A series of informal lecture-discussions, about the physiological effects of increased weight, how people respond to a person who is heavier than average, the external and internal factors that trigger eating.

Neural Basis of Learning and Memory. This course examines experimental approaches to study the neural basis of learning and memory: neurophysiological, biochemical, pharmacological and behavioral. Principles discovered in the laboratory will be applied to memory disorders encountered in clinical situations.

Personality Factors in Illness and Recovery. This course examines the role of individual differences in personality as they affect such questions as who will fall ill, who will seek help, and who will recover. Type A personality and coronary disease; need for power, hypertension and alcoholism; depression as a predictor of cancer are described.

Alternative Modes of Healing. The course focuses upon approaches to the facilitation of healing as practiced by such treatment modalities as osteopathy, chiropractic, spiritual healing, naprapathic, reflexology as well as traditional branches of medicine. Presentations are made by representatives of alternative modes of treatment. (20 hours)

Living and Dying. This seminar considers questions often occurring in care of the dying: ethical issues (right to die), personal reactions of patients and care-givers, alternative modes of terminal care, and suicide. (20 hours)

Psychology, Psychiatry and the Law. In conjunction with an attorney, selected cases are presented illustrating contemporary inter-relationships between mental health, the law, and psychiatry; e.g., the issues surrounding the insanity defense as currently utilized in Illinois.

Developmental Psychophysiology of Normal and Abnormal Infants. The developing response capabilities and behavioral milestones of normal infants are used to define aberrant psychophysiological processes in high-risk and brain-damaged infants. Effects of premature birth and perinatal anoxia and hypoxia are emphasized in the context of the special problems of parenting sick or behaviorally abnormal infants.

Illness Behavior. The circumstances under which people who experience symptoms seek out medical care is viewed in terms of major conceptual models of such behavior.

Parenting and Child Abuse. This course is an introduction to the stresses of normal parenting. The primary focus is on the abnormal parenting of abusive parents. Although the reasons behind child abuse and treatment for children and families are considered, our focus is on the physician's role in reporting, working with parents, and working with the courts. The format includes class discussion, lectures, invited lectures by pediatricians and lawyers, and examination of case material.

The Psychology and Psychopathology of the Aging Process. This course focuses on the normal and psychopathological processes of aging and the physician's role in the total health care of the elderly patient. Topics for discussion include: 1) normal psychology of the aging process; 2) interviewing techniques with elderly patients; 3) depression, paranoid reactions, and organic brain syndromes in elderly patients; 4) psychological and psychopharmacological treatment approaches with elderly patients; and 5) the physician and the chronically ill and dying patient.

Psychology and Physiology of Sleep. This course provides a general introduction to the physiology and psychology of sleep. It covers both normal sleep and dream patterns and the deviations that occur with various medical and psychiatric problems. It also covers the diagnosis and treatment of insomnias and hypersomnias, nightmares, and bad dreams. (20 hours)

Sociology of the Hospital. A variety of topics are covered in this course but primarily the focus is on five issues: what organizational variables influence the quality of patient care; what types of dilemmas arise when one attempts to provide clinical services in a bureaucratic system; how do external groups exert social control over hospitals; what is the role of the patient and his/her family in the social structure of the hospital and what changes are occurring (e.g., Patients' Bill of Rights); and finally, how can social and organizational factors that relate to illness and patient care be modified to increase the quality of care provided. Findings from a study that has been conducted here at the Medical Center and that pertains to the relations between organizational factors and the quality of care are discussed when appropriate.

Therapy in the Family. This course acquaints the student with the theory and practice of family treatment. The properties of the family system are discussed utilizing as examples either video tape or the students' own experiences. The format includes case studies, video tapes of families and family treatment interviews done by noted family therapists as well as didactic presentations. One section deals exclusively with the role of the family in psychosomatic illness. (20 hours)

Topics in Human Sexuality and Health Care. This course reviews several aspects of human sexuality including gender identity development, gender role in men and women, the human sexual response in the male and female, taking a sex history in clinical practice, sex and medical illness, and basic aspects of sex therapy in general practice. (20 hours)

Biochemistry

BIOCH 301
Basic Biochemistry. A lecture course designed as an intensive introduction to biochemistry. Emphasis is on descriptive chemistry of the main classes of biochemical compounds and metabolic processes in the human organism and on changes associated with disease processes. [Prerequisite: one year general chemistry, one course organic chemistry, Kachmar, F, (4-0-4)]

BIOCH 401, 402
Clinical Chemistry I, II. A course on the analytical and biochemical basis of methods used for chemical analysis of body fluids as related to diagnosis and treatment of disease. Topics discussed include blood sugar, carbohydrate tolerance tests, renal function tests, plasma electrolytes, blood gases, proteins, enzymes, liver function tests, cholesterol, and lipids. Critical evaluation of methods is emphasized. The laboratory includes experiments designed to instruct students in the quantitative analysis of clinically important metabolites. Emphasis is placed on accuracy, quality control, and fine technique. Manual methods are stressed, with a variety of methods and instruments used. The student learns to apply error theory and statistics in interpreting and evaluating results. [Prerequisite: BIOCH 301. Kachmar, W, (4-0-4); Sp, (3-6-5)]

BIOCH 403, 404
Clinical Chemistry III, IV. These courses cover these tests and topics: chemical hematology, special proteins, vitamins, biogenic amines, elementary toxicology, thyroid function tests, and steroid methods. Principles underlying automated and computer application methods will be discussed. [Prerequisite: BIOCH 401, 402, Kachmar, W, Sp, (2-0-2)]

BIOCH 461, 462, 463
Biochemistry I, II, III. A course in the chemistry and metabolism of biologically important compounds, amino acids, and proteins; nucleic acids and protein synthesis; bioenergetics; biochemical function of enzymes; common pathways of metabolism; carbohydrates and lipid metabolism. Additional topics include the integration of cellular metabolism; regulation of hydrogen ion concentration; the reproduction of the molecular level, including genetic coding and DNA replication, transcription and translation; nucleic acids and disease; hormones; regulation of whole body metabolism; biochemical role of vitamins; calcium and phosphate metabolism. Required of medical students. [Bezkorovainy and Staff, F, W, S, (4-0-4)]

BIOCH 501
Advanced Biochemistry I. An advanced lecture course considering enzymology, cell physiology, and the chemistry of the important classes of biological substances, including carbohydrates, lipids, amino acids, proteins, and nucleic acid. It also covers biochemical investigation; chemical thermodynamics; properties of solutions, electrode potentials, chemical kinetics and membrane phenomena. [Sky-Peck and Staff, F, R, (5-0-5)]

BIOCH 502
Advanced Biochemistry II. An advanced lecture course considering biological oxidations, the pathways of metabolism, the control and regulation of metabolism, nutrition; and the chemical nature, biosynthesis, evolution, and mechanism of action of the hormones. Specific topics deal with the metabolism of proteins, lipids, and carbohydrates with particular attention to recent developments. [Sky-Peck and Staff, W, R, (5-0-5)]

BIOCH 503
Advanced Biochemistry III. Topics include structure, physical, and chemical properties of polynucleotides and their components; physical and chemical properties and biosynthesis of nucleic acids; transfer and messenger RNA; and the role of nucleic acids in protein synthesis. Other topics are the biochemical structure and function of specialized tissues, including: the liver, muscle and muscle contraction mechanisms, hemopoietic system, kidney, bone, and connective tissue. [Sky-Peck and Staff, Sp, R, (5-0-5)]

BIOCH 581
Biological Research Techniques. Discussion and laboratory work surveying and illustrating the practical aspects of biochemical methodology and instrumentation; techniques for the isolation, analysis, and characterization of biologically important substances; and the fundamental principles of radioisotope techniques, and enzyme assay. [Prerequisite: BIOCH 503, Staff, Alt F, Alt Sp, S, X, (2-4-4)]

BIOCH 590
Special Topics in Biochemistry. An advanced course dealing with selected topics in biochemistry. The particular subjects vary from year to year. One to three topics are considered each time the course is given. Topics include: biochemical genetics; chemistry of enzymes; phytochemistry. [Prerequisite: BIOCH 501, Staff, F, W, Sp, X, (3-0-3)]

BIOCH 595
Seminar and Journal Club. Student and faculty presentation of assigned subjects of current importance in biological chemistry and related fields. Assigned reading. [Staff, F, W, Sp, R, (1-0-1)]

BIOCH 598
Research in Biological Chemistry. Research on problems of biological importance with members of the graduate staff. [Prerequisite: BIOCH 503, Staff, F, W, Sp, S, X, (0-v-v)]

BIOCH 602
Biochemistry of Disease. The alterations of metabolic pathways in various organs and tissue compartments are studied in relation to organ, metabolic, and genetic pathology. The biochemical derangements are illustrated with case demonstrations. Topics are selected and discussed in depth with emphasis on current research work. The facilities of the clinical chemistry laboratory are available to illustrate biochemical changes and their significance. [Prerequisite: BIOCH 463 or 503, Sky-Peck, Alt F, X, (2-0-2)]

Cell Biology

CEBIO 501
Cell Biology. Study of ultrastructure and function of the cell organelles; structures covered include the plasma membrane organization, cell-to-cell communication, and cell surface immunoreceptors. Also covered are the mitochondria and phosphorylation, the endoplasmic reticulum, golgi apparatus and cell secretion, the cytoskeleton and molecular basis of motility, and the nucleus and cell division. [B. Eisenberg, W, (2-0-2)]

CEBIO 512
Scientific Basis of Electron Microscopy. This course provides facts about electron microscopy where possible and practical approaches where not. Techniques include the chemical basis of fixation; size and shape changes during fixation, dehydration, and embedding; plastic and frozen thin sectioning; selective staining and immunocytochemistry; autoradiography. Also discussed will be the physics of electron optics and the theory of transmission, scanning, high voltage, and x-ray detector electron microscopy. [Instructor's permission, B. Eisenberg, Sp, (2-0-2)]

CEBIO 522
Electron Microscopy Laboratory. Practical techniques of electron microscopy are addressed. Students dissect, fix, and imbed tissue. They will be taught the use of the ultramicrotome to stain thin sections and the use of the electron microscope. The goal of the course is the preparation of electron micrographs of research quality. Extensive time for practical use of the equipment will be available. [Prerequisite: CEBIO 512, B. Eisenberg, Sp, (0-8-4)]

CEBIO 531
Stereology. This course will present practical and theoretical approaches in the application of measurement to anatomical structures. General principles of estimation of volume surface area and number will be covered by stereology and other techniques. [Instructor's permission, B. Eisenberg, R, (2-0-2)]

CEBIO 533
General Pathology. The general concepts of pathology are studied, with an introduction to cell injury, inflammation, immune response, metabolic and toxic pathological processes and neoplasia. The lectures and seminar groups are accompanied by laboratory work in the microscopic anatomy of pathological changes. [Prerequisite ANAT 455-6 or instructor permission, B. Pauli, F, (3-4-5)]

CEBIO 599
Independent Study. [Staff x, (v-v-v)]

Health Care Education

HLCED 454
Development of Instructional Media. The study of media as arts of communication. A survey of communication theory and its relationship to the communication process. Utilizing various instructional media, students design a program of instruction relating to some aspects of the health professions. [Block, R, (2-0-2)]

Health Care Systems

HCSYS 521
Systems of Health Care. Seminar course in the study of the health care delivery system in the U.S., with particular emphasis on identifying historical forces that have shaped the current system for health care, the organization of the hospital and the medical center, current manpower roles in health care, and the current issues that face the health system today. Discussion will also focus on external forces and controls that substantially affect the health care system. Students will be expected to write a research paper and present it orally to the class. [Staff, Sp, (2-0-2)]

Health Systems Management

HSMGT 301
Health Care Management. Organizational design and managerial processes of planning, organizing, directing, and controlling, as well as the dynamics of managerial jobs, are studied. Emphasis is on management strategies and techniques in the area of health care delivery. [Staff, Sp, (3-0-3)]

HSMGT 452
Contemporary Analysis of the Health Science Professions. A seminar study-group approach to selected contemporary issues in the health professions. (The selection of issues will change from time to time as high-intensity trends develop or as student needs develop.) The issues selected will range across the social, ethical, legal-legislative, economic, and historical roots of the health professions. Senior or graduate standing. [Staff, X, (2-0-2)]

HSMGT 503
Management Techniques. This course presents a broad overview of four areas of basic organizational and management theory: planning, organizing, directing and controlling. [Staff, W, (3-0-3)]

HSMGT 505
Social Organization of Health Care. This course presents an overview of various health care organizations from a social science perspective. Analyses of hospitals, alternative forms for health care delivery, external forces affecting these organizations and consumer/community awareness are covered in lectures and practical experiences. [Staff, F, (6-0-6)]

HSMGT 513, 514
Advanced Health Care Concepts, I, II. This course consists of three distinct activities: student seminars, tours and faculty seminars. Each student is required to prepare both a verbal and written presentation on a current topic in health care. Tours are planned to give the student an opportunity to discuss learned material with practitioners on an informal basis. Seminars will be con-

ducted once each month by a faculty member on his/her current area of research or other interests. [Staff, F, W, (1-2-2)]

HSMGT 521, 522
Management of Health and Hospital Systems I, II. An exploration of the health spectrum and the prevalent delivery systems with special emphasis on the hospital's relationship with its consumers. Students will study various managerial sub-systems commonly found in health care settings and review the constraints placed on management (internal and external) in operating these systems. Areas that will be covered include variables affecting health and health systems, materials management, facilities planning and management, managerial systems, and marketing. [Staff, Sp, F, (2-4-4)]

HSMGT 524
Treatment Process. An introduction to elements (systems) of the health treatment process affecting both inpatients and outpatients. Students will observe the practice patterns of various health providers, examine systems for monitoring the quality of care, identify elements of treatment support systems affecting the operations of the health treatment system, and identify the consequences of these and other systems on the patient as an individual. [Staff, Sp, (2-4-4)]

HSMGT 528
Health Care Environment–An Organizational Perspective. Introduction to various theories of organization behavior and their relevance to management of clinical and patient care processes. Special emphasis is on problems related to implementing change in the health environment at both the corporate and unit levels in the organization. Focus includes use of control systems to monitor the progress or stagnation of an institution. Limited enrollment. [Staff, X, (4-0-4)]

HSMGT 531, 532
Financial Management I, II. Study of accounting/financial management principles for students of varying backgrounds and the application of these principles to the myriad operational problems in the not-for-profit environment. The role of financial management in the operation of a health-care institution will include such topics as accounting, managerial and cost accounting, budgeting, and rate setting. [Staff, Sp, F, (2-4-4)]

HSMGT 541, 542
Health Law I, II. A survey of the law affecting the health care industry with emphasis upon the major legal issues arising in a hospital setting. Students study state and federal statutes, regulations, and reported court decisions in detail. [Staff, Sp, F, (2-0-2)]

HSMGT 544
Organizational Analysis. A study of the interactions of the various systems within an organization and their impact on the overall purposes and objectives of the institution. Emphasis will be on formulation of a framework for analyzing complex organizations, identification of potential organizational problems, and creation of a new organization. Unique frameworks for problem solving are encouraged. Students will be expected to rationally and systematically analyze strengths and weaknesses of organizational functions and the relationships between the organizations and internal and external systems. [Staff, W, (3-0-3)]

HSMGT 551
Information Systems I. Students are exposed to the important relationship between administrative information needs and alternate levels of information reporting. Specific topics include planning, evaluation, implementing and maintaining information systems and exposure to alternative methods of computer-based information systems. [Staff, W, (4-0-4)]

HSMGT 553
Computers for Health Systems Managers. This course provides the student with a broad base of technical and conceptual computer skills. The student is exposed to the evolution of computer hardware, alternatives within the computer field and fundamental concepts. Emphasis is on the effective use of computers rather than on the technical manipulation of data. [Staff, F, (2-0-2)]

HSMGT 554
Experimental Design/Research Methodology. The student is exposed to and develops specific research techniques. Alternative forms for evaluation are analyzed, as well as the important interrelationships between managerial concerns and statistical requirements. This course provides the student with the necessary bases for his/her concentrated study including methods for proposal writing and results reporting. [Staff, F, (2-0-2)]

HSMGT 555
Medical Care Organization. An analysis of the administration of personal health care in the United States, including ambulatory services and home health services, and evaluations of health systems. Models and issues such as supply and demand will be approached from an administrator's perspective. Attention will be given to the roles of "new health practitioners," cost data, political or power models, and problems and trends in the development of a national health policy. [Staff, Sp, (2-0-2)]

HSMGT 561, 562
Health Planning I, II. Planning theories, strategies, and methodologies related to the management of health resources and the development of health policy will be studied. Planning will be approached from a variety of perspectives, including area-wide and institutional planning at both a micro and macro level. Particular emphasis will be given to legislation and regulatory constraints as they affect planning strategies and health policy and to the important role of multi-hospital systems in the future delivery of health services. The knowledge of quantitative techniques and systems and concepts from previous courses will be used in the student's approach to problem solving. [Staff, W, Sp, (2-4-4)]

HSMGT 583, 584
Statistical Techniques I, II. An exploration of statistical techniques with emphasis on data collection, statistical inference, hypotheses testing, and problem solving. Statistical Package for the Social Sciences will be used throughout. Emphasis is on the conceptual rather than the technical approach to statistical appraisal. [Staff, F, W, (4-0-4)]

HSMGT 585, 586
Quantitative Methods I, II. An exploration of quantitative techniques as applied to hospital decision making. Topics include time and motion study, decision trees, cybernetic control and mathematical optimization. Emphasis is on the conceptual development and solution to problems in a quantitative manner. The practicum focuses on application of techniques discovered during lectures. [Staff, F, W, (3-2-4)]

HSMGT 598
Concentrated Study. This course varies with each student. It can consist of thesis, independent study and /or electives in one of four areas of study: health law/public policy, health economics and financial management, management of hospitals and health care facilities and industrial engineering/operations research. Each student, working with a faculty member, will propose a plan for fulfillment of this requirement which must be approved by the Curriculum Committee. [Staff, X, (v-0-v)]

HSMGT 599
Independent Study. [Staff, X, (v-0-v)]

Hematology

HEM 301
Hematology I. Study of normal hematopoiesis including development, metabolism, and function of red cells, white cells, and platelets and an introduction to the various associated hematologic disorders. Includes laboratory experiences dealing with basic routine tests performed in a clinical hematology laboratory, such as simple automated cell counting, differential counting, and sedimentation rates. [Staff, W, (3-6-5)]

HEM 425
Hematology II. Review of normal

hematopoiesis and an indepth study of erythrocyte disorders, their etiologies, pathophysiology, clinical features, and significant laboratory findings. [Prerequisite: HEM 301, Staff, F, (2-0-2)]

HEM 426
Hematology III. Continuation of HEM 425 with an indepth study of leukocyte and hemostasis disorders that covers etiology, clinical features, and significant laboratory findings. [Prerequisite: HEM 425, Staff, W, (2-0-2)]

Humanities

HUM 461
Physician as Writer. A vigorous exploration of selected fiction, chronicles, and autobiography by distinguished 20th century physician-writers (including William C. Williams, Chekhov, and Azuela). Focus will be on writers' unique responses to questions of medical ethics, involvement in social issues, and doctor-patient relationships as well as on the physician as philosopher and humorist. [Cohen, Vidaver, F, (2-0-2)]

HUM 462
Physician on Stage and in Fiction. A vigorous investigation of distinguished 19th and 20th century plays and novels that feature the doctor as a major character. Works by G.B. Shaw, Eugene O'Neill, Fredrick Durrenmatt, Tennessee Williams, Henrik Ibsen, and Sinclair Lewis examine the physician in crises, the profile of a scientific man, the psychiatrist as character, and the American regional practitioner. [Cohen, Vidaver, W, (2-0-2)]

HUM 463
Disease As Subject in Contemporary Literature. This course will vigorously examine the depiction of disease in outstanding fiction and poetry, as well as in the memoirs, journals, and personal narrations of some distinguished contemporary writers who faced disease and analyzed their experiences with acute perception. Works by Albert Camus, Andre Gide, Eleanor Clark, John Updike, Thomas Mann, John Berryman, and Katherine Ann Porter will be considered. Lectures, readings, and discussion. [Cohen, Vidaver, Sp, (2-0-2)]

Immunology

IMMUN 301
Basic Immunology. An introduction to the basic concepts and terminology of immunity including development, structure, and function of the lymphoid systems, the basis of antigenicity, antibody structure, methods of detection and measurement, mechanism of cellular immunity, white cell function, hypersensitivity reactions, the complement system, and mechanisms of immune suppression and tolerance. Methods of laboratory evaluation of humoral and cellular immunity are introduced. [Siegel, W, (3-0-3)]

IMMUN 402
Clinical Immunology. Study of clinical and applied immunology as it relates to the role of the immune response in production of disease; primary and secondary immunodefiency atopy and other forms of hypersensitivity, autoimmunity, transplantation and tumor immunity. The use of immunology as a diagnostic, prognostic and therapeutic aid is studied. [Prerequisite: IMMUN 301, Gewurz, F, (2-0-2)]

IMMUN 403
Clinical Serology. Students will learn to apply the fundamental concepts of antigen-antibody interactions to routinely performed assays of syphilis and non-syphilis serology. Laboratory sessions cover proficiency in performance and familiarity with purpose, principle, and interpretation of the following tests: RPR, CSF-VDRL, TPA, FTA-ABS, Monospot, Monotest, Heterophile, ASO, AHT, ANTI-DNAase B, RF Latex, RF SCAT, Anti-Thyroglobulin and Anti-Microsomal. [Prerequisite: IMMUN 301, Bishop, Sp, (2-6-3)]

IMMUN 421
Immunohematology. Blood group antigens and antibodies from the discoveries of Landsteiner in 1900 to the present day are studied. Blood banking procedures involved in drawing, testing, storing, and transfusing whole blood and its components are discussed. The laboratory section of this course will deal with the basic blood bank procedures including ABO grouping, RH typing, compatibility testing, and special antibody studies. [Prerequisite: IMMUN 301, Rojek, Sp, (2-6-3)]

IMMUN 501
Basic and Clinical Immunology: Lecture Segment. A comprehensive introduction to immunology, with emphasis on basic concepts and principles, followed by study of clinical applications. Topics include antibody structure; antigen-antibody reactions; genetic and cellular control of antibody synthesis; the complement system; phagocytosis, inflammation, and non-specific immunity; immediate and delayed hypersensitivity; cellular immunity; transplantation immunology and immunogenetics; and tumor immunology. [Hansen, F, (5-0-5)]

IMMUN 502
Basic and Clinical Immunology: Tutorial Segment. Tutorial sessions encompassing a detailed discussion of topics encountered in IMMUN 501. [Lint, F, (3-0-3)]

IMMUN 503
Structure and Immunobiology of Membranes. Introduces chemical and physical approaches involved in understanding the intricacies of membrane structure and function. Emphasis is placed on the physicochemical dynamics of lipid-lipid and lipid-protein interactions. Included are discussions of available protocols and techniques used in the immunobiological analysis of membranes. [Potempa, Alt. W, (4-0-4)]

IMMUN 504
Molecular Immunology. Topics include structure of immunoglobulins, hapten-antibody reactions, the antibody combining site, antibody heterogeneity, nature of antigens, immunochemistry of membranes, structure of histocompatibility and blood group antigens, and the molecular basis of antibody diversity. [Osmand, Alt. W, (4-0-4)]

IMMUN 506
Complement. A detailed consideration of the structure and function of the complement proteins and inhibitors, modes of activation and control, biological functions, genetics, and inborn and acquired abnormalities. [Mold, Alt. Sp, (4-0-4)]

IMMUN 507
Clinical Immunology. A lecture and laboratory course which during each of ten weeks reviews critical topics in clinical immunology from three standpoints on consecutive days: (a) laboratory assays including history, principles and procedures; (b) clinical correlations including indications, interpretations and appropriate case studies; and (c) applications in investigation including significant past and current patient and disease-related observations, current issues and elaboration of experimental models. Topics considered include immunology of infectious disease, immunohematology, histocompatibility typing, complement, autoimmune diseases, lymphoproliferative diseases, immunodeficiency diseases, tumor immunology, and allergy. [James, Luskin and Gewurz; Alt Sp (6-0-6)]

IMMUN 508
Phagocytosis and Host Defense. The first half of this course involves a consideration of mononuclear phagocytes, polymorphonuclear leukocytes, opsonization, mechanisms of chemotaxis, phagocytosis and intracellular digestion, metabolic pathways in phagocytes, and the role of the phagocyte in disease. The second segment introduces concepts of "non-specific" host defense mechanisms, the secretory immune system, and host defense against parasites. [Lint, Alt Sp, (2-0-2)]

IMMUN 509
Cellular Immunology I. Immunogenetics and Antibody Formation. Introduction to major histocompatibility complexes, ontogeny of T and B-cell lineages, and the genetics of antigen receptor expression and immunoglobulin synthesis. The roles of B-cells, T-cells, macrophages and major histocompatibility complex products in the development and expres-

sion of an antibody response is discussed. Regulation of immune responses, tolerance and current concepts of cell interaction models are presented. [Plate/Hansen Alt. W (4-0-4)]

IMMUN 510
Cellular Immunology II. Cellularmediated Effector Mechanisms. Introduction to T-cell mediated mechanisms, antibody dependent cell-mediated cytotoxicity (ADCC), natural killer cells and macrophage mediated cytolysis. T-cell subpopulation description, functions and interactions, as well as models of T-receptor selection in the thymus are studied. Adaptive differentiation, H-2 restriction, allogeneic recognition, and cell cloning techniques also are discussed. [Baum/Plate Alt. S (4-0-4)]

IMMUN 511
Immediate Hypersensitivity and Inflammation. The first segment of this course focuses on the structure and regulation of IgE synthesis, the definitions of allergens, mechanisms of histamine release from human cells, and experimental models used to study allergic phenomena. The second segment introduces the essential concepts of the inflammatory response; topics include the interactions of humoral effector mechanisms (the clotting, kinin, plasmin, and complement systems) with each other and with both blood-born and tissue-fixed cellular elements. [Thomas/ Fiedel, Alt W. (4-0-4)]

IMMUN 581
Laboratory Tutorial. A program of laboratory tutorials designed to acquaint the student with two or three separate research laboratories in the first year, in order to gain familiarity with the field and to aid in advisor selection. [Fiedel, F, W, Sp, S, R (v-v-v)]

IMMUN 599
Pre-Thesis Research. [Principal Advisor, S, F, W, Sp (v-v-v)]

IMMUN 601
Independent Study. Specialized coursework designed around the particular needs of an individual student. [Staff, F, W, Sp, S, X (v-v-v)]

IMMUN 602
Special Topics. Designed to consider indepth selected contemporary topics in immunology, such as host-parasite relationships, ontogeny and transplantation immunology, hypersensitivity states, etc. [Staff, F, W, Sp, S, X (v-v-v)]

IMMUN 603
Advanced Immunogenetics. A study of current areas of research efforts in which immunogenetic parameters are applied to further the understanding of the immune system. Topics include the t locus; major histocompatibility antigens; genetic control of immune responses; adaptive differentiation; MHC restriction; Ta, Tla, and 2a cell surface markers; T-B; T-T, and T-macrophage cell interactions; regulation of immune responses and sexual preference. [Prerequisite IMMUN 504, 509 and 510. Plate/Knight (U.I.M.C.), Alt. F, (4-0-4)]

IMMUN 699
Thesis Research. [Principal Advisor, F, W, Sp, S (v-v-v)]

Medical Technology

MEDTK 301
Basic Laboratory Skills. Study and practice of basic laboratory skills used in the various clinical laboratory areas. Topics covered include instrumentation, proper use and maintenance; manual skills such as pipetting, titrating and venipuncture; preparation and standardization of reagents; laboratory calculations. [Staff, F, (1-9-4)]

MEDTK 302
Patient Care Techniques. Clinical experience in the hospital patient care areas includes blood collection, specimen handling and processing procedures, as well as interaction with patients and professional staff of the hospital. [Prerequisite: MEDTK 301, Staff, W, (0-4-1)]

MEDTK 303
Body Fluid Analysis. Analysis of various body fluids with emphasis on the theory and practice of clinical procedures. Component topics will include the analyses of urine, gastric juice, cerebral spinal fluid, feces, semen, transudates and exudates. [Miller, Stumpe, F, (3-3-4)]

MEDTK 421
Practicum in Clinical Chemistry. Rotation through the hospital clinical biochemistry laboratories. Application of basic skills learned in student chemistry laboratory; instrumentation and advanced methodologies are dealt with. [Whisler, F, W, Sp, (0-24-8)]

MEDTK 422
Practicum in Hematology. Rotation through the hospital clinical hematology laboratories. Application of basic skills learned in student laboratory; instrumentation and advanced methodologies are dealt with. Radiohematology, bone marrow techniques, and coagulation are included. [Staff, F, W, Sp, (0-24-8)]

MEDTK 423
Practicum in Immunology. Rotation through the hospital clinical immunology laboratory. Application of basic skills learned in student laboratory; instrumentation and advanced methodologies are dealt with. [Bishop, F, W, Sp, (0-16-4)]

MEDTK 424
Practicum in Microbiology. Rotation through the hospital clinical microbiology laboratories. Application of basic skills learned in student laboratory; instrumentation and advanced methodologies are dealt with. [Gvadzinskas, F, W, Sp, (0-16-8)]

MEDTK 425
Practicum in Immunohematology. Rotation through the hospital blood bank laboratory. Application of basic skills learned in student laboratory; instrumentation and advanced methodologies are dealt with. [Carr, F, W, Sp, (0-16-4)]

MEDTK 441
Seminar in Medical Technology. Discussion of current topics in medical technology and associated fields. Students present abstracts. [Miller, Stumpe, F, W, Sp, (2-0-2)]

Microbiology

MICRO 311
Diagnostic Bacteriology. Special emphasis is on diagnostic procedures employed in the clinical bacteriology laboratory, such as specimen collection, isolation and identification of medically important bacteria, antibiotic sensitivity testing, and determination of serum antibiotic levels. Course includes laboratory exercises associated with these various concepts. Development of proficient skills in these various techniques is stressed. [Kaplan, W, (3-9-5)]

MICRO 411
Parasitology, Mycology and Virology. This course provides clinical background in mycology, parasitology, and virology. Emphasis is on the disease involved and on diagnostic procedures used in the laboratory. The laboratory portion consists of identification, specimen collection, and processing of medically important viruses, fungi, and parasites. [Prerequisite: MICRO 311, Staff, Sp, (3-6-5)]

MICRO 451
Microbiology Concepts. The course is designed to acquaint the students with the basic morphological and physiological characteristics of infectious agents. Emphasis is placed on organisms of importance in human disease. General classification of infectious agents, the mechanisms by which these organisms contribute to disease states, and laboratory identification are emphasized. Demonstrations and laboratory work accompany the lecture portion of the course. Required for first year medical students. [Staff, Sp, (4-2-5)]

MICRO 501
Clinical Microbiology. Specimen collection, organism isolation and identification, and interpretation of serology are studied. Infec-

tions of various organ systems are covered as a lecture-seminar series and by assignment of pertinent readings. [Staff, Sp, X, (v-v-3)]

MICRO 502
Viral Oncology. This course offers a comprehensive review of biologic, immunologic, and molecular properties of animal and putative human oncogenic viruses. Techniques employed for investigating the role of viruses in neoplasia are reviewed. Elective, alternative years by arrangement. [Prerequisite: MICRO 451 or 501, Staff, F, X, (3-0-3)]

MICRO 503
Animal Models of Human Diseases. Natural and experimental diseases of animals are compared with similar diseases in man. Models of selected infectious, immunological, degenerative, metabolic, and neoplastic diseases are presented as a lecture-seminar with bibliographies provided for each model system. [Staff, W, X, (2-0-2)]

MICRO 601
Clinical Bacteriology. The experience provides rotation in each section of the diagnostic bacteriology laboratory with emphasis on laboratory identification of pathogenic bacteria and normal flora. Experience is also provided in the techniques applicable to office diagnostic bacteriology. Clinical work is provided by arrangement with the infectious disease section. Specimens from patients on the infectious disease service provide data for learning clinical microbiology. Laboratory projects are available for students wishing to pursue individual interests. [Prerequisite: MICRO 451, Staff, X, (v-v-v)]

MICRO 602
Diagnostic Virology. Specimen collection, virus isolation and identification, and the interpretation of virus serology are studied. Laboratory work involves isolation, identification, and serological techniques of the diagnostic virology laboratory. By arrangement with the infectious disease section, students select cases to be studied in parallel with the laboratory. [Prerequisite: MICRO 451, Staff, X, (v-v-v)]

Nutrition

NUTRI 421
Nutrition During the Life Cycle. Course provides educational and clinical skills that will enable the student to integrate the role of nutrition in meeting the needs of an individual in health and disease. The course will be divided into four parts: cultural, social, and psychological influences on food habits; food needs and costs; nutrition and health; and nutrition in clinical care. [Staff, S, X, (3-0-3)]

NUTRI 455
Ecology of Nutrition. The sociological, psychological, economic, political, and cultural factors that affect the intake of required nutrients are observed on a global basis. Ecological imbalance, nutritional diseases, and their long-term ramifications on the individual and his/her world are studied in detail. [Staff, Alt Sp, (3-0-3)]

NUTRI 466
Advanced Human Nutrition. An indepth study in advanced nutritional concepts that integrates the sciences of biochemistry and physiology. [Prerequisite: one course in nutrition or permission of instructor, Staff, F, X, (4-0-4)]

NUTRI 501
Nutritional Interrelationships. A study of the dynamic interaction between the animal and its environment, particularly the diet. Chemical and metabolic phenomena involved in the development and maintenance of the mammalian organism are covered as well as regulation as a means of adaptation. Emphasis is on understanding requirements for specific nutrients in individuals and populations, evaluations of food intakes and dietary habits, and on nutritional needs during pregnancy and lactation, growth and maturation, and disease. [Prerequisite: BIOCH 462, Narins, Sp, (2-0-2)]

NUTRI 524
Assessment of Nutritional Status. Course is designed to teach students the theoretical basis for the various tools used in assessment

of nutritional status, as well as to develop their critical skills in evaluating the relative merits of measurements used and to provide the opportunity to do assessments. In addition, students will be taught interviewing skills. The course is equally divided between lectures and practical experience. [Prerequisite: one course in human nutrition, biochemistry, physiology or permission of the instructor. Staff, F, (2-2-4)]

NUTRI 531
Nutritional Self Study. Student designs and completes a clinical study using a diet usually developed for a patient. Study must include a literature review, experimental plan, experimental data and detailed discussion of data. Student is expected to do certain analysis as part of the study. [Prerequisite: NUTRI 524 and BIOCH 463. Staff, S (0-1-1)]

NUTRI 511
Practicum I. Student will do a comprehensive study on one patient including an assessment of nutritional status in relation to disease state. The student will integrate data obtained during the assessment with additional information from the medical record and current research on the pathophysiology of the disease and rationale for diet therapy. Student will formulate a nutrition care plan, working with the patient, and instruct the patient in the diet modification, revising the plan if necessary. Student will make medical record entries as appropriate after consultation with practicum preceptor. [Prerequisite: 14 quarter hours including NUTRI 524, Staff, W, (0-3-1)]

NUTRI 512
Practicum II. Student will be able to provide total nutritional care for an assigned number of patients. After observing clinical preceptor, student will begin to develop and implement a nutritional plan of action by working with the patient and his or her family. Student will begin to participate in Kardex rounds, physician rounds, in-service and other meetings related to nutritional care of patients. This is a concentrated two-week experience. There will be discussion of cases presented by students, and clinical care conferences. [Prerequisite: 24 quarter hours which must include NUTRI 511, BIOCH 462 and PHYSO 512. PPHYS 576 may be taken concurrently. Staff, X, (0-10-3)]

NUTRI 513
Practicum III. Student will have the opportunity to become proficient in implementing and evaluating nutritional care through practice. Student will build on the skills obtained in NUTRI 512. Prior to experience, student will identify specific goals to be accomplished during this experience. Student and clinical preceptor will evaluate performance against these goals and also with a form which identifies student progress and degree of integration of theory and practice. Student will also present a different patient during these clinical case conferences to the students and clinical nutrition faculty. [Prerequisite: NUTRI 512, Staff, S, X, (0-14-4)]

NUTRI 555
Ecology of Nutrition. Same course as NUTRI 455, reserved for clinical nutrition studlents. Students prepare lectures and assist in presentations for NUTRI 455. [Staff, Alt Sp, (4-0-4)]

NUTRI 561
Special Topics in Nutrition. Mini-courses covering topics of current interest; length of mini-course will be ten lecture/seminars. Topics will vary. Examples are: total parenteral nutrition, drug-nutrient interaction, nutrition and aging, inborn errors of metabolism and protein metabolism. May be taken more than once. One credit for each mini-course taken. [Staff, W, Sp, S, (1-0-1)]

NUTRI 565, 566, 567
Seminar in Nutrition I, II, III. Presentations on current topics in nutrition by guest speakers and presentations on recent literature by students. [Narins, Dolecek, F, W, Sp, (1-0-1)]

NUTRI 591
Independent Clinical Study. Student will either participate in an ongoing study as an investigator or carry out a modification of the study designed in HLCED 584. Project must be approved by advisor and preceptor six weeks before the beginning of the quarter in which the study is to be done. [Prerequisite: HLCED 584 and NUTRI 501, Staff, S, X, (0-0-2, 0-0-5)]

NUTRI 599
Independent Reading. Student undertakes directed readings and discussions with preceptor on a selected topic in nutrition to complement his/her learning goals. It is expected that the student will write a substantive review of the topic after completing the readings. Students must contact preceptor before registering. [Staff, S, X, (0-0-2, 0-0-5)]

Pathophysiology

PPHYS 576
Nutritional Pathophysiology. Study of the pathophysiology and medical management of disorders related to nutrition and the nutritional status of human beings. [Prerequisite: PHYSO 512, Staff, Sp, (2-0-2)]

Pharmacology

PHARM 303
Nursing Pharmacology I. Course offers general information about drugs, particularly terms used in pharmacology, and factors affecting absorption, distribution, biotransformation, and elimination of drugs. Drugs affecting the autonomic nervous system are discussed. [Moon, W, (2-0-2)]

PHARM 304
Nursing Pharmacology II. Therapeutically important classes of pharmacological agents are considered in detail to illustrate pharmacological principles and mechanisms of drug activity. [Moon, Sp, (2-0-2)]

PHARM 501
Medical Pharmacology. General aspects of the physicochemical factors governing drug-receptor interactions, absorption, distribution, biotransformation, and excretion of drugs are considered as well as drugs affecting the autonomic nervous system. [Staff, F, (4-1-4)]

PHARM 502
Medical Pharmacology. A continuation of PHARM 501. Virtually all important classes of therapeutically useful agents are considered. [Staff, W, (4-1-4)]

PHARM 503
Medical Pharmacology. A continuation of PHARM 502. [Staff, Sp, (2-0-2)]

PHARM 504
Advanced Medical Pharmacology. A study of mechanisms of action of special classes of drugs. Emphasis is on the pharmacophoric moiety and the relationship of the chemical structure to the biological activity. [Prancan, Sp, X, (4-0-4)]

PHARM 521
Laboratory Instrumentation. Course covers principles and applications of experimental equipment. Techniques that make use of such equipment will include ultraviolet and visible spectrophotometry, spectrophotofluorometry, thin-layer chromatography, column chromatography, high pressure liquid chromatography, gas chromatography, mass spectrometry, atomic absorption, liquid scintillation spectrometry, platelet aggregation, oxygen measurement, blood pressure and flow measurements, cardiac tension measurement, tissue oxidation, isotope use and handling, pH adjustment, sample weighing, melting point determination, hematocrit determination, centrifugation, and glassware cleaning. [Parkhurst, Sp, X, (0-6-3)]

PHARM 541
Research in Blood Genetics and Pharmacogenetics. [Carson, Frischer, X, (0-v-v)]

PHARM 598
Research In Pharmacology. [Prancan, X, (0-v-v)]

PHARM 603
Biochemical Pharmacology. Topics include biochemical aspects of pharmacokinetics, structure-function, drug-receptor interactions, and comparative pharmacology. [Prerequisite: PHARM 502, Moon, Alt Sp, R, (3-0-3)]

PHARM 604
Neuropharmacology. Seminar course presenting both preclinical and clinical aspects of drugs used in the treatment of neurologic and psychiatric disorders. [Prerequisite: PHARM 503, Klawans, Alt F, Alt W, Alt Sp, R, (2-0-2)]

PHARM 605
Animal models in neuropharmacology. Seminar. [Prerequisite: PHARM 604, Klawans, X, (2-0-2)]

PHARM 621
Cardiovascular-Renal Pharmacology. Course in advanced concepts of drug action as they relate to hypotension, hypertension, and altered flow states. [Prerequisite: PHARM 502, Prancan, Alt F, R, (3-0-3)]

PHARM 622
Cardiovascular Experimental Methods. A laboratory course concerned with the techniques involved in preparing experimental cardiovascular animal models. [Prerequisite: PHARM 503, Boyd, Prancan, X, (0-4-4)]

PHARM 631
Clinical Pharmacology and Therapeutics. Study of integration of clinical work with therapeutic aspects of pharmacology; includes discussion of the pharmacology, clinical pharmacology, therapeutics, and clinical applications for major drug groups. [Prerequisite: PHARM 503, MacLeod, Sp, (4-0-4)]

PHARM 641
Pharmacogenetics. Advanced tutorial covering current concepts in genetic influences on pharmacodynamics. [Prerequisite: PHARM 503, Carson, X, (3-0-3)]

PHARM 691
Pharmacology Seminar. [Staff, F, W, Sp, (1-0-1)]

PHARM 699
Dissertation Research. [Staff, X, (0-v-v)]

Physiology

PHYSO 451
Physiology I. Comprehensive medical physiology course covering all of the major organ systems. A conceptual approach to understanding of physiological functions is developed. Emphasis is placed on utilization of facts in problem-solving. [Staff, F, (5-1-5)]

PHYSO 452
Physiology II. Continuation of PHYSO 451. [Prerequisite: PHYSO 451, Staff, W, (5-1-5)]

PHYSO 502
Introductory Membrane Biophysics. Study of fundamental processes involved in movement of ions across membranes, excitability in nerve and muscle, equivalent circuit analysis, artificial membrane systems, structure of membranes, active transport processes. [Schauf, Alt F, R, (4-0-4)]

PHYSO 503
Physiology of Striated Muscle. Topics include fundamentals of excitation-contraction coupling, mechanics of muscle, equivalent circuit analysis, muscle biochemistry, developmental aspects of nerve and muscle. [Donaldson, Alt F, R, (4-0-4)]

PHYSO 511
Nutritional Physiology I. Comprehensive coverage of all major organ systems forms the basis of discussions of the nutritional aspects. [Vilas, F, (4-0-4)]

PHYSO 512
Nutritional Physiology II. A continuation of PHYSO 511. [Narins, W, (5-0-5)]

PHYSO 513
Cardiovascular Physiology. Students will read and discuss the original papers that form the foundations for our current understanding of heart function and control, peripheral vascular control, and transcapillary exchange. The works will be evaluated both in terms of their significance at the time and their present relevance. [Rovick, Alt Sp, R, (4-0-4)]

PHYSO 514
Functional Neurophysiology. The course will deal with physiology of neurons and glia, synaptic processes, sensory receptor physiology, spinal cord, cerebellum and motor control, peripheral mechanisms in sensory systems, and higher functions of the nervous system. Relevant neuroanatomical concepts will be included. [Staff, Sp, (4-2-4)]

PHYSO 523
Circuit Theory and Practical Design. A tutorial laboratory course designed to acquaint the student with the principles of design and construction of various electronic equipment commonly encountered in modern physiology. [Guiffre, Alt W, R, (3-2-4)]

PHYSO 524
Linear Differential Equations and Transform Methods. Study of first and higher order linear equation, linear algebra techniques, finite difference equations, Fourier series and transforms, Laplace transforms, and applications to solution of differential equations [Mathias, Alt W, R, (4-0-4)]

PHYSO 525
Linear Systems Analysis. Topics include block diagrams, feedback, frequency domain analysis, noise and its analysis, and partial differential equations and their solution are studied. [Prerequisite: PHYSO 524, Mathias, Alt W, X, (4-0-4)]

PHYSO 526
Control in Physiological Systems. Course covers control theory, the human motor system, and feedback interactions in the human motor system. [Gottlieb, Alt Sp, X, (4-0-4)]

PHYSO 598
Introduction to Research. A tutorial course designed to familiarize students with the literature and techniques applicable to modern physiological research. [Staff, F, W, Sp, S, X, (v-v-v)]

PHYSO 640
Applied Electrophysiology. An advanced laboratory course introducing students to the basic techniques of modern electrophysiology. [Prerequisite: PHYSO 502, 503, 523, Staff, Alt S, X, (3-6-6)]

PHYSO 641
Molecular Mechanisms in Control of Ion Permeability. Advanced course dealing with special topics in the molecular control of excitability and laboratory instruction in voltage clamp techniques. Offered alternate years by arrangement. [Prerequisite: PHYSO 502, Schauf, Cohen, Alt F, X, (4-0-4)]

PHYSO 651
Advanced Topics in Muscle Physiology. Topics include equivalent circuit of skeletal muscle, problems in excitation-contraction coupling, and molecular events in the generation of mechanical force. [Prerequisite: PHYSO 503, Donaldson, Eisenberg, Alt F, X, (4-0-4)]

PHYSO 652
Active Transport Processes. A detailed study of the physiological and biochemical processes involved in the energy-dependent translocation of solutes across cell membranes. [Prerequisite: PHYSO 503, Hegyvary, Alt W, X, (4-0-4)]

PHYSO 653
Problems in Synaptic Physiology. A detailed review of current experimental and theoretical problems in transmitter release and activation of post-synaptic receptors. [Prerequisites: PHYSO 451, 503, 514, Lewis, Alt Sp, X, (4-0-4)]

PHYSO 655
Sensory Neurophysiology. An advanced tutorial dealing with the function of sensory systems and information processing. [Prerequisite: PHYSO 514, Levett, Hoeppner, Alt W, X, (4-0-4)]

PHYSO 656
Neural Correlates of Behavior. An advanced tutorial dealing with the organization of simple invertebrate nervous systems and the relation between electrical properties of its elements and behavior [Prerequisite: PHYSO 514, 655, Michael, Alt Sp, X, (4-0-4)]

PHYSO 699
Thesis Research. Postcandidacy research by arrangement with staff. [Staff, F, W, Sp, S, X, (v-v-v)]

Preventive Medicine

PRMED 531
Introductory Biostatistics. A basic introduction to the understanding and use of statistics in the health sciences. Topics covered include descriptive statistics, probability, sampling, point and interval estimation, and hypothesis testing with students and chi-square. The student will also be taught to use a statistical package on the computer. [Raynor, F, (3-0-3)]

PRMED 532
Introductory Statistical Data Analysis. This course, along with Intermediate Statistical Data Analysis (PRMED 533), teaches the basic tools necessary to design and analyze a study along sound statistical lines. This course introduces the techniques of regression models and analysis of variance. [Prerequisite: PRMED 531, Raynor, W, (3-0-3)]

PRMED 533
Intermediate Statistical Data Analysis. This course will complete the course of study started in Introductory Statistical Data Analysis (PRMED 532). This course will primarily consider the techniques of analysis of variance and analysis of covariance. There will also be some consideration of multivariate analysis techniques and sampling design. [Prerequisite: PRMED 532, Raynor, Sp, (3-0-3)]

PRMED 599
Independent Study. Advanced topics in Biostatistics. [Prerequisite: Instructor's permission, Raynor, X, (v-0-v)]

Religion and Health

RELH 453
Illness and Faith. Course examines the patients' understanding of body, time, shame, community, the self, sacrifice and suffering, religious resources, and the relationship between God and illness in the light of their faith. Employs seminar method and some clinical materials. Please consult faculty before enrolling. [R, Burck, F, W, Sp (2-0-2)]

RELH 501
The Art of Healing. An 11-week intensive clinical course focusing on the interpersonal dimensions of the healing process; appreciation of the patient as a total being; exploration of the anxieties and inhibitions generated in relating to the sick; specialized communication skills; and perception of the patient as a partner in the healing task. The course also assists the student to discover and use his/her own uniqueness in relating therapeutically to the sick.

Note: Students may be accepted for this course from any discipline or field of study. The descriptions of seminars that follow are built upon the experience of teaching the course for theological students. However, no difficulty is inherent in incorporating non-theological students into the course.

Prerequisite: For theological students at least one year of graduate theological education *and* an interview with one of the faculty of the Department of Religion and Health. For non-theological students an interview with one of the faculty of the Department of Religion and Health. [R, Staff, F, W, Sp, S, (9-25-v)]

RELH 611
Clinical Case Conference. This clinical seminar uses verbatim written materials or tape recordings of actual patient visits by students. One student presents material each seminar period; all students present in a sequence which they construct. Verbatim materials are circulated to seminar members in advance of the seminar to allow careful preliminary study.

The supervisor and the seminar members engage the presenting student in an examination of his ministry. Together they explore the student's understanding of the patient's communication, the student's assessment of the patient's pastoral needs, the student's attempt to carry out an appropriate ministry, the student's ability to use his/her own faith meaningfully in his/her ministry, and the meaning of the student's subjective response to patients. [Prerequisite: RELH 501, Staff, F, W, Sp, S, (3-25-v)]

RELH 615
Sermon Preparation and Delivery. Students prepare a sermon manuscript and give the sermon in the hospital chapel with their seminar group as the audience. Seminar then relocates and the preaching experience is examined in terms of its appropriateness to the hospital congregation, its articulation of the faith, its witness to the faith and development of the student, and its effectiveness as interpersonal communication. Usually these sermons are amended and given during a Sunday worship service in the hospital chapel. [Prerequisite: RELH 501, Staff, F, W, Sp, S, (1-1-v)]

RELH 621
Personal and Professional Concerns. This seminar gives students the opportunity to report spontaneously on critical events and issues in their hospital ministry; to examine issues of personal or professional identity; to examine problems in communicating or functioning within the seminar group; to explore the meaning and context of their ministry, their relations with other medical center disciplines, their ability to think theologically about their experience; to examine individual problems of functioning effectively in the pastoral role; and to assist students in evaluating their progress in training. [Prerequisite: RELH 501, Staff, F, W, Sp, S, (1-1-v)]

RELH 623
Didactic Presentations. Presentations are made by professionals in other disciplines, by supervisory staff, and by students themselves in an attempt to bring theoretical material to bear on the practical work of ministry and to assist the student in clarifying his/her operational concepts.[Prerequisite: RELH 501, Staff, F, W, Sp, S, (1-1-v)]

From time to time the didactic presentations are more structured to cover various important topics. Some subjects that have been presented in the past or that will be covered in coming quarters include:

Suffering: Its Importance for Health. This seminar explores the various philosophical and theological responses to suffering and their expression among hospital patients. The implications of the different responses to suffering for healing are explored.

Aging, Faith, and Health. A brief survey of the important biological, psychological, and social changes that accompany aging sets the background for an exploration of the role of faith in the life of older persons, and particularly in their adjusting to and coping with illness.

Faith as a Factor in Health. A brief survey of the major theories of disease and health, scientific and unscientific, Western and non-Western, forms the background for a review of the literature on the role of faith, trust, and hope in recovery from illness. Case examples from student's experience are also reviewed. [Prerequisite: RELH 501, Staff, F, W, Sp, S (2-0-v)]

RELH 650
Individual Supervision. Supervisor and student together develop an individualized contract for learning. The student is enlisted as a partner in the learning process by helping him/her identify goals, plan for learning, and evaluate progress. Written records of pastoral work are examined in detail as well as written and oral attempts of the student to understand and incorporate the values from the total program experience and to synthesize the clinical, theological, and theoretical data encountered. Supervision of the student on the floor while seeing patients is also provided. [Prerequisite: RELH 501, Staff, F, W, Sp, S (v-v-v)]

RELH 681
Guided Study or Research. Each student is expected to undertake a reading or research program that is complementary to his/her learning goals and/or remedial in terms of gaps in basic preparation for understanding pastoral care. Supervisor is consultant to the student for the study program. Note: Expected of year-long students only. [Prerequisite: RELH 501, Staff, F, W, Sp, S (v-v-v)]

RELH 685
Clinical Practice. Each student has a designated area of pastoral responsibility, usually 40 to 50 beds. Student is assisted to develop

working relationships with the treatment team and to develop a style of coverage appropriate to the area.

Each student serves once per week as on-call chaplain for overnight or weekend coverage and/or does an evening of visiting with preoperative patients. These special duties involve the student of ministry in situations of crisis or heightened anxiety.

Clinical practice requires special arrangements for non-theological students. [Prerequisite: RELH 501, Staff, F, W, Sp, S (v-25-v)]

RELH 689
Comprehensive Evaluations. Each student prepares a written evaluation of himself or herself and the total program experience. This evaluation is shared with the supervisor and fellow students and examined with the student in seminar and individually. The evaluation periods assist the student to examine his or her investment in learning, goals, use of program resources, relationships, and progress toward learning goals. The supervisor prepares a detailed written evaluation of the student at the end of the program that is usually shared with the student. The comprehensive evaluations are necessary for determining satisfactory completion of the course and given credit where appropriate.

The course may not be taken more than twice for academic or field work credit. [Prerequisite: RELH 501, Staff, F, W, Sp, S (v-0-v)]

Speech and Hearing Sciences

SHS 501
Speech and Hearing Science. Various aspects of physiologic and acoustic phonetics are examined as well as the relationship between production and perception. Introductory psychoacoustics. Instrumentation. Experimental and applied research in speech and hearing science is critically examined. [Wolfe, Klodd, F, (3-2-3)]

SHS 503
Introduction to Neurosciences. Neural mechanisms underlying normal speech and language processes are emphasized. Sensory-motor systems are integrated. Neuropathologies and associated speech, language, memory, personality and intellectual impairments are surveyed. [Staff, W, (3-0-3)]

SHS 505
Audiology I. Basic audiological methods, pure tone audiometry, masking, speech audiometry, and tolerance testing. [Harsch, F, (3-0-3)]

SHS 506
Audiology II. Special behavioral methods designed to provide differential diagnosis of auditory pathology. [Klodd, Staff, W, (3-0-3)]

SHS 511, 512, 513
Speech-Language Pathology Practicum I, II, III. Supervised clinical experience with patients presenting speech, language, voice, fluency or swallowing impairments. Development of evaluative, therapeutic, counseling and report writing skills. The relationship of speech-language pathology to other health care professions is examined. [Staff, F, W, Sp, (v-v-v)]

SHS 514
Practicum in Audiology. Same content as SHS 516, 517, 518. Designed for majors in Speech-Language Pathology. [Staff, S, (v-v-3)]

SHS 516, 517, 518
Audiology Practicum I, II, III. Supervised clinical experience with patients displaying various hearing impairments. Development of skills in diagnostic evaluation, obtaining case histories, counseling and treatment techniques for pediatric through geriatric patients. The relationship of audiology to other health care professions is examined. [Staff, F, W, Sp, (v-v-v)]

SHS 519
Practicum in Speech-Language Pathology. Same content as SHS 511, 512, 513. Designed for majors in Audiology. [Staff, S, (v-v-3)]

SHS 521
Childhood Language I. Language acquisition. Examines relationships among structure and use of language; cognition, environmental

stimulation, ethnic and social status factors. Course considers language acquisition from theoretical, neural-organic, and descriptive perspectives. [Ratusnik, Bacon, F, (3-0-3)]

SHS 522
Childhood Language II. Language disorders in children. Emphasis on the nature of language delay or breakdown associated with known or unknown etiologic factors. Consideration of sensory-motor processing disturbance in language disordered children. Assessment and therapeutic techniques are studied. Lectures by pediatric psychologists and pediatricians complement course. [Ratusnik, Bacon, W, (3-0-3)]

SHS 524
Fluency, Dysfluency and Stuttering. Developmental fluency factors are examined with emphasis on differentiation of normal dysfluency from deviant patterns. Theories of causation are related to management of stuttering. Evaluation and therapeutic procedures are examined in conjunction with clinical observation. [Ratusnik, Staff, Sp, (3-0-3)]

SHS 526
Industrial Audiology. Requirements, evaluation techniques for hearing conservation programs in industry and the community. [Staff, Sp, (3-0-3)]

SHS 527
Total Communication. Theories and practical knowledge of oral and manual communication systems for the deaf and hard of hearing. [Harsch, S, (3-0-3)]

SHS 531
Amplification for the Hearing Impaired. Examines the history of hearing aids, techniques for selection of hearing aids, electroacoustic analysis with microprocessors and manikins, government regulations, and delivery systems. [Klodd, Staff, W, (3-0-3)]

SHS 533
Aural Rehabilitation. Analysis of techniques and principles of auditory and visual skills to be developed by the deaf and hard of hearing individual from childhood through geriatric. [Robinson, Staff, Sp, (3-0-3)]

SHS 541
Anatomy, Physiology, and Pathology of the Auditory System. Study of the anatomy and basic principles of physiology as they relate to the auditory system. Diseases and injuries of the hearing mechanism are examined with focus on audiological findings. Lecture and selective observation with otolaryngologists complement classroom topics. [Klodd, Staff, F, (3-0-3)]

SHS 542
Electronystagmography. Anatomy and physiology of the vestibular and ocular motor systems, disorders of patients presenting vertiginous symptoms, with emphasis on technique and interpretation of ENG. [Robinson, Sp, (2-1-3)]

SHS 543
Electrophysiologic Assessment of the Auditory System. Reviews the principles of electrophysiologic testing. Analysis of electrodermal audiometry, heart rate audiometry, electrocochleography, brainstem evoked potentials, and cortical evoked potentials. [Klodd, Staff, S, (3-0-3)]

SHS 544
Child Audiology. Investigation of neonatal and childhood auditory disorders; emphasis on various means of evaluation and treatment. [Harsch, S, (3-0-3)]

SHS 551
Diagnostic Methods in Speech-Language Pathology. Examination of evaluative procedures and tests used with children and adults. History gathering and counseling techniques are studied. The student is provided experience in taking histories, test administration and interpretation and counseling. Medical and behavioral evaluative models are critically examined. Lectures by other health care specialists complement coursework. [Staff, F, (3-0-3)]

SHS 561
Articulation Disorders. Review of phonemic development, classification of articulation impairment, etiologic and theoretic considerations. Contemporary basic and applied research is examined. Evaluative procedures, tests, and therapeutic procedures are emphasized. Clinical observation and limited involvement in evaluations are provided. [Ostreicher, Staff, F, (3-0-3)]

SHS 562
Communicative Disorders Associated With Cranio-facial Anomalies. In addition to cleft palate and cleft lip, various craniofacial anomalies and associated communicative impairments are studied. Assessment and treatment procedures are presented and supplemented with observation. A segment of the course concerns management of speech and swallowing in head and/or neck cancer patients. Lecture and selective observation with otolaryngologists and pediatricians complement classroom topics. [Staff, S, (3-0-3)]

SHS 563
Voice Disorders. Symptomology, etiology, diagnosis and treatment of voice disorders is presented. Vocal characteristics, assessment and management of various vocal pathologies are emphasized. Application of spectrographic analysis and EMG biofeedback to hyperfunctional vocal conditions. A segment of the course concerns management of speech and swallowing in head and/or neck cancer patients. Lecture, demonstration and selective observation with otolaryngologists complement classroom topics. [Wolfe, Staff, W, (3-0-3)]

SHS 564
Aphasia and Other Symbolic Disorders. Course provides historical perspectives. Neurolinguistic disorders are examined from connectionistic and holistic points of view with consideration of contemporary clinical research. Normal process and impairment of swallowing reviewed. Emphasis on clinical assessment, test batteries, and treatment with observational experiences. Lectures, selective observation with neurologists, neurosurgeons and neuropsychologists complement speech-language topics. [Ostreicher, Sp, (3-0-3)]

SHS 565
Motor Speech Disorders. Dysarthria associated with central and peripheral nervous system dysfunction is examined from neurophysiological, theoretical and clinical perspectives. Assessment and treatment procedures are emphasized. A segment of the course concerns management of communicative disorders in cerebral palsied individuals with experience at external sites. Lectures, selective observation with neurologists, neurosurgeons and neuropsychologists complement speech topics. [Ostreicher, Staff, Sp, (3-0-3)]

SHS 581
Introduction to Graduate Research. Emphasis on today's library and information retrieval systems, critical analysis of research in behavioral science, hypothesis testing, methodology, descriptive and inferential statistics, form and style in dissemination of research. Focus on parametric and nonparametric statistical models most relevant to research problems in speech and hearing science. Introductory computer programming. [Ratusnik, S, (3-0-3)]

SHS 590
External Practicum in Speech-Language Pathology. Supervised clinical experience at Rush Network Hospitals or cooperating institutions. [Staff, F, W, (v-0-10)]

SHS 591
Advanced Clinical Training. Advanced training in speech-language pathology or audiology. [Staff, F, W, Sp, S, (v-v-v-)]

SHS 595
External Practicum in Audiology. Supervised clinical experience at Rush Network Hospitals or cooperating institutions. [Staff, F, W, Sp, S, (v-0-10)]

SHS 598
Thesis. Under the guidance and direction of a faculty member and committee, the student originates, proposes and executes an experiment. Theses answer significant clinical or basic research questions and reflect a high degree of scholarship in speech and/or hearing science. [Staff, F, W, Sp, S, (v-0-3)]

SHS 599
Independent Study. Creative project designed by student and supervised by faculty. [Staff, F, W, Sp, S (v-0-3)]

Faculty of College of Health Sciences

June 1, 1979

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Rush University Affiliations

The colleges of Rush University are located at the main campus of Rush-Presbyterian-St. Lukes Medical Center at 1753 West Congress Parkway, Chicago, Illinois 60612

The College of Health Sciences
The College of Nursing
Rush Medical College

Affiliated Colleges

Beloit College, Beloit, Wisconsin 53511
Carleton College, Northfield, Minnesota 55057
Coe College, Cedar Rapids, Iowa 52402
The Colorado College, Colorado Springs, Colorado 80903
Cornell College, Mount Vernon, Iowa 52314
Fisk University, Nashville, Tennessee 37203
Grinnell College, Grinnell, Iowa 50112
Illinois Institute of Technology, Chicago, Illinois 60616
Knox College, Galesburg, Illinois 61401
Lake Forest College, Lake Forest, Illinois 60045
Lawrence University, Appleton, Wisconsin 54911
Macalester College, St. Paul, Minnesota 55105
Monmouth College, Monmouth, Illinois 61462
Ripon College, Ripon, Wisconsin 54971
St. Olaf College, Northfield, Minnesota 55057

Clinical Network

Bethany Hospital, Chicago, Illinois
Central DuPage Hospital, Winfield, Illinois
Christ Hospital, Oak Lawn, Illinois
Community Memorial General Hospital, La Grange, Illinois
Galesburg Cottage Hospital, Galesburg, Illinois
Grant Hospital of Chicago, Chicago, Illinois
Mile Square Health Center, Inc., Chicago, Illinois
Mount Sinai Hospital Medical Center, Chicago, Illinois
Schwab Rehabilitation Hospital, Chicago, Illinois
Sheridan Road Pavilion, Chicago, Illinois
Skokie Valley Community Hospital
Swedish Covenant Hospital, Chicago, Illinois
West Suburban Hospital, Oak Park, Illinois

For more information
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Chicago, Illinois 60612
(312) 942-7100

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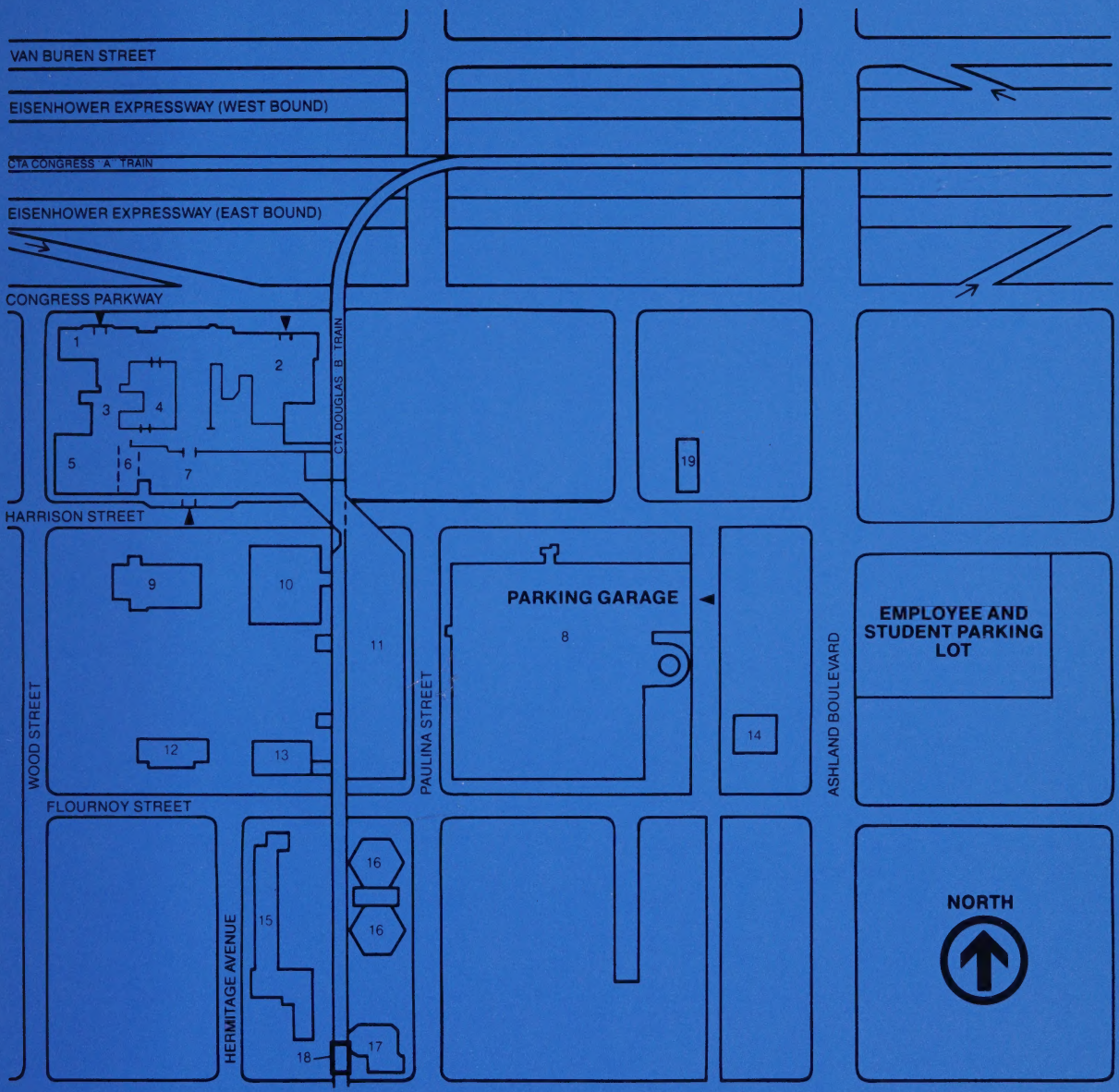
Rush-Presbyterian-St. Luke's Medical Center
Rush University Campus



1. Jones Pavilion
2. Kellogg Pavilion
3. Murdock
4. Cafeteria
5. Rawson
6. Senn
7. Jelke Southcenter
8. Parking Garage
9. Schweppe-Sprague Building
10. Professional Building
11. Academic Facility
12. Kidston Apartments
13. McCormick Apartments
14. Laurance Armour Day School
15. Marshall Field IV Mental Health Center
16. Johnston R. Bowman Health Center for the Elderly
17. Central Refrigeration Plant
18. Polk Street Station, CTA
19. Warehouse